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Energy Research Abstracts

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UNITED STATES DEPARTMENT OF ENERGY

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ENERGY RESEARCH ABSTRACTS

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The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

Information in *ERA* is available for on-line searching as part of the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

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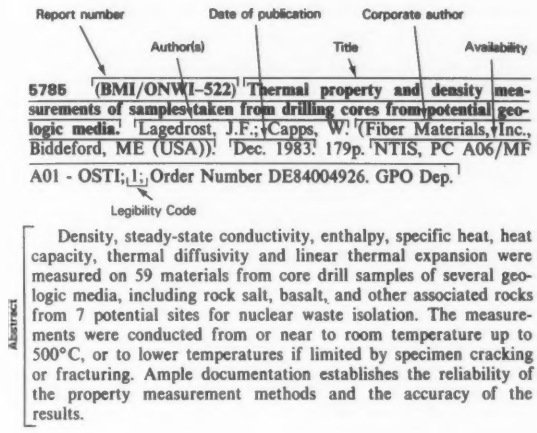
Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

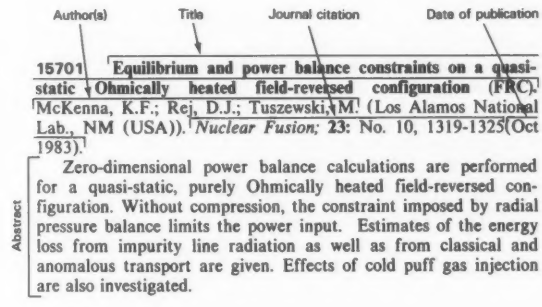
Office of Scientific and Technical Information
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI–522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01 - OSTI; Order Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI–522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

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Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

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DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI–522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI–522	9:5785	NTIS, PC A09/MF A01. OSTI Order Number DE84004926, Distribution Category MN-70

INFORMATION SOURCES

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada
Denmark
Finland
France
Federal Republic of Germany
Italy
Japan
The Netherlands
Norway
Spain
Sweden
United Kingdom
United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, OSTI both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

SUBJECT CONTENTS (NUMERICAL LISTING)

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

0103 Preparation

19165 **(CONF-8810104—1) Wet carbonization of lump-size low-rank coals: Process and economics.** Laurens, R.L.; Lau, F.S.; Punwani, D.; Roberts, M.J. (Institute of Gas Technology, Chicago, IL (USA)). 1988. Contract AC21-84MC21225. 36p. NTIS, PC A03 - OSTI. Order Number DE89007162/JAW.

From Upgrading low-rank coals conference; Denver, CO, USA (18 Oct 1988).

Wet carbonization is a thermochemical process for beneficiating low-rank coals. In this process, coals are heated in the presence of water to temperatures in the range of 400{degree} to 650{degree}F at elevated pressure to prevent vaporization. The chemical reactions that occur during the process decompose carboxylic-acid groups in coals resulting in carbon dioxide and water evolution, and produce a solid product that has a higher heating value, lower sodium content, and improved dewaterability and weathering characteristics. Under a DOE-funded program, research was undertaken to develop a data base for the wet carbonization of lump-size low-rank coals. The program included wet carbonization tests with four different low-rank coals from laboratory-scale batch unit to process development scale unit. A process scheme for the wet carbonization of lump-size low-rank coals was developed and the economics (preliminary) of the process were estimated. The plant capacity for the base case was sufficient to produce beneficiated feedstock to operate a 500 MW(e) coal fired power plant. The heart of the process is a solid-liquid moving-bed reactor. Heating of the water is achieved by direct steam injection. Solid feed to the unit is accomplished by using cost-effective hydraulic lockhopper systems. The integrated plant also includes: solids handling, product discharge and storage, product gas cooling, steam generation, wastewater treatment, and utilities. 20 refs., 15 figs., 8 tabs.

19166 **Reactivity of sulfur on alkali-treated coal surfaces.** Baltrus, J.P.; Diehl, J.R.; D'Este, J.R.; Ladner, E.P. (Pittsburgh Energy Technology Center, U.S. Dept. of Energy, P.O. Box 10940, Pittsburgh, PA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

The surface interactions of alkali with coal and mineral matter have been studied by ESCA to establish a basis for predicting the relative reactivity of alkali with sulfur during coal beneficiation processes. The speciation of sulfur in several coals doped with various alkali salts were quantified following heating of the samples to 375°C in air or N/sub 2/ and after washing them with water. Organic and pyritic sulfur react with the alkali cation when heated, after which the sulfide or oxidized sulfur product can be washed from the coal. The extent of reaction between the alkali salt and sulfur is governed by the size of the cation and the electronic properties of the anion; large alkali cations are more reactive, as are anions with stronger nucleophilic properties.

19167 **Characterization of superclean coals.** Kim, N.K.; Everett, R. (Michigan Technological Univ., Houghton, MI (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

The superclean coals produced by the static flotation technology of Michigan Technological University (MTU) are being studied for their suitability and hydroliquefaction feedstocks. The micronized (90% minus 22 microns) and successfully clean coals which range from 3% to as high as 43% in ash content and also contain sulfur as low as 1% are assessed in terms of composition and various physical properties.

19168 **Characterization of components released during the molten caustic leaching of coal.** Gollakota, S.V.; Chriswell, C.D.; Markuszewski, R. (Ames Lab., USDOE, Iowa State Univ., Ames, IA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

In order to understand better the reactions occurring during the chemical cleaning of coal by the molten caustic leaching (MCL) process, improve the leaching conditions, enhance desirable reactions leading to a clean coal, and suppress undesirable side reactions leading to consumption of coal carbon and expensive caustic, the products of the molten caustic leaching process require detailed characterization. Work at the Ames Laboratory had led to the development of unique analytical protocols for the characterization of inorganic products of the MCL process. In addition to other routine analyses, specific procedures applicable to the determination of total sulfur, sulfide sulfur, and elemental sulfur, in MCL process steams are described. Also, new experimental procedures are described which have been developed for the determination of soluble, gaseous, and condensable organic effluents from the MCL treatment of coal. The nature of these organic materials is characterized, and their composition is related to the operating conditions of the process. With these analytical capabilities, process conditions can be better monitored for more effective operation.

0104 Processing

REFER ALSO TO CITATION(S) 19168, 19195, 19196, 19214, 19549, 19684, 19865

19169 **(AFME—87-11-0041-5) Efficient use of fuels - coal. Proceedings.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1987. 142p. (EN, FR). (CONF-870350—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756979/JAW.

From MEI 87: European technical symposium on energy management in industry; Paris, France (31 Mar 1987).

Various performant coal utilization processes are presented: combustion of pulverized coal and lignite for the dehydratation of agricultural products, description of the Cerchar pulverized coal burner and drum dryer for road coated granulates; presentation of the fluocarbelf process for the preparation and the combustion of coal-water, wastes-water mixtures, and its application to industrial vapour production; description of three different fluidised bed coal combustion or gasification processes.

19170 **(AIST—8802) Japan's sunshine project 1987 annual summary of coal liquefaction and gasification.** (Agency of Industrial Science and Technology, Tokyo (Japan)). Apr 1988. 320p. (In Japanese). NTIS (US Sales Only), PC A14. Order Number DE88756449/JAW.

Subjects of studies on the coal liquefaction included: liquefaction and engineering characteristic values of a number of coal types; catalyzers; utilization of liquefaction products; direct hydrogenation reaction and prevention of carbonization; and solubility in

solvents. Conceptual design was established on the coal liquefaction data base (CLDB) for data collection and development of processing systems. In addition, researches were conducted on the application technology, including liquefied oil upgrading and petroleum mixing techniques and tests for environmental safety evaluation. The NEDOL, a 1 t/d experimental plant was constructed and a test run was completed for liquefaction of bituminous coal. Adjustment of primary and secondary hydrogenation systems and test run are under way with the pilot plant for brown coal liquefaction with capacity of 50 t/d. Research on the coal gasification included gasification characteristics of various coal types and high efficiency gasification processes. (122 figs, 65 tabs, 1 photo, 193 refs)

19171 **(CANMET—SP86-2) Biotechnology bibliographies.** Beaudette, L.A.; McCready, R.G.L. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1987. 100p. (MICROLOG—88-01544). Canada. Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $12.50 OTHER COUNTRIES $15.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Four bibliographies are included in this document, covering articles and scientific papers from around the world written mostly in English. Citations are presented alphabetically by author under the topics of: acid mine drainage (coal and metals) and bioadsorption of metals; solution mining; metabolism and physiology of thiobacillus and other microorganisms; and bacterial leaching of metals.

19172 **(CONF-871113—9) Temperature distribution in a fluidized bed with a central jet.** Hariri, H.; Rehmat, A.; Arastoopour, H. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 31p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007169/JAW.

From American Institute of Chemical Engineers annual meeting; New York, NY, USA (15 Nov 1987).

Experimental runs were conducted in a fluidized-bed with a central jet using a 6-inch-ID glass column. Air was introduced at the distributor and central jet. Some runs were conducted in an empty bed. Polyolefin particles (d/sub p/ = 0.322 mm, melting temperature = 130{degree}C) were used as bed material in all the fluidized-bed runs. The fluidizing and jet air temperatures were varied within a range to form a "hot zone" in the center of the column and right above the distributor plate with temperatures higher than the melting temperature of the bed material. For each run, the temperature was measured at more than 50 locations inside the fluidized bed at different distances from the central axis and various heights from the distributor plate. Isotherms were drawn using these measurements. 14 figs., 6 tabs.

19173 **(CONF-880770—2) Mild gasification of coal: Potential opportunities for value-added uses.** Sala, D.L.; Babu, S.P.; Bair, W.G.; Wootten, J.M.; Duthie, R.G. (Institute of Gas Technology, Chicago, IL (USA)). 1988. Contract AC21-87MC24266. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007154/JAW.

From Coal - targets of opportunity workshop; Washington, DC, USA (12 Jul 1988).

Mild coal gasification is discussed. Emphasis is upon a market survey for gasification co-products. 13 refs., 3 figs., 4 tabs. (CBS)

19174 **(CONF-880915—1) Results of in-situ desulfurization tests in the U-GAS coal gasification process.** Bryan, B.G.; Goyal, A.; Patel, J.G.; Ghate, M.R. (Institute of Gas Technology, Chicago, IL (USA)). 1988. Contract AC21-85MC22061. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007158/JAW.

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

A high-pressure coal gasification Process Development Unit (PDU) has been used by the Institute of Gas Technology to study in-situ desulfurization in an ash-agglomerating, fluidized-bed coal gasifier at elevated pressures. Previous work in this area has been limited to pressures up to about 225 psig. The current work extends this pressure range to 400 psig; well within the pressure range of the combustion turbines now being considered for application in Integrated Gasification Combined Cycle (IGCC) power plants. The coal used in this study was Pittsburgh No. 8 bituminous coal and the sorbent used was New Enterprise limestone. Data were collected and analyzed to determine the effects of gasifier pressure and temperature on sulfur capture within the fluidized bed. The optimum temperature for maximum sulfur removal was determined as a function of the partial pressure of CO_2 in the fluidized bed. 8 refs., 10 figs., 2 tabs.

19175 **(CONF-880915—2) Experimental and theoretical investigation of the formation and growth of ash agglomerates.** Carty, R.H.; Mason, D.M.; Kline, S.; Babu, S.P. (Institute of Gas Technology, Chicago, IL (USA)). 1988. Contract AC21-84MC21313. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007155/JAW.

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

The behavior of coal mineral matter is of concern in ash-agglomerating gasifiers because it governs deposition on gasifier internals and down-stream surfaces as well as ash removal. The ultimate aim of the IGT research program in ash chemistry is to be able to predict quantitatively the behavior of the mineral matter in a fluidized-bed gasifier based on the operating of the gasifier and a minimum analysis of the characteristics of the mineral matter present in the coal feed. The current program combines experimental studies and a theoretical analysis to accomplish this objective. In this paper, the reaction of the coal mineral matter with limestone used as a sulfur-capture agency is discussed. When limestone is used to capture sulfur in a fluidized-bed coal gasifier, the factors affecting the utilization of the limestone including its interaction with the coal ash become very important. One of these factors is the behavior of the coal mineral matter in the reactor, especially the type and extent of its reaction with the limestone particles. In this work, the reaction of the coal mineral matter with the limestone particles was investigated by study of the ash discharge and bed material from a pilot plant test in which limestone was used for sulfur capture and tests in a 2-inch-ID reactor in which mixtures of limestone plus coal char were gasified with steam plus air. Examination of the ash residues of these tests has led to the formulation of a tentative description of the behavior of the coal ash. 6 figs., 7 tabs.

19176 **(CONF-8808104—2) Sulfur-specific microbial metabolism of organic compounds.** Kilbane, J.J. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 15p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007159/JAW.

From DOE Office of Fossil Energy workshop on bioprocessing of coals; Tyson's Corner, VA, USA (15 Aug 1988).

Research has resulted in the development of an experimental methodology for the purposeful isolation/development of bacterial cultures capable of sulfur-specific metabolism and the development of a sulfur-specific bioassay. Through the use of sulfur-limited continuous culture bioreactors, a mixed bacterial culture, IGTS7, was isolated and shown by GC/MS analyses to be capable of the sulfur-specific metabolism of a range of organic substrates. The removal of organic sulfur from coal by IGTS7 can be as high as 91%. However, IGTS7 is incapable of growth at the acidic pH typical of conditions conducive to the microbial metabolism of inorganic sulfur. Therefore, one strategy to develop a single-step microbial process for the complete desulfurization of coal would be to use genetic engineering techniques to isolate the genes that encode sulfur-specific metabolic functions for organic compounds from microorganisms such as IGTS7 and achieve enhanced expression of those functions in an acid-tolerant host. 7 refs., 3 figs., 4 tabs.

19177 **(CONF-8809228—1) Sulfur-specific metabolism of organic compounds.** Kilbane, J.J. II. (Institute of Gas Technology, Chicago, IL (USA)). 1 Jul 1988. 10p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007151/JAW.

From American Chemical Society Division of Fuel Chemistry meeting; Los Angeles, CA, USA (25 Sep 1988).

The microbiological removal of sulfur from coal has shown to be capable of removing 90% or more of the inorganic sulfur,

while the microbiological removal of organic sulfur from coal is certainly less complete and is less will-documented. More than 90% of the total sulfur must be removed for any pre-combustion coal desulfurization process to obviate the need for subsequent desulfurization. Therefore, the focus of current research concerning the microbiological removal of sulfur from coal centers is on the removal of organic sulfur. Biodegradation of dibenzothiophene (PBT) is discussed. 6 refs., 2 figs., 2 tabs.

19178 **(CRIE-W—87002) Simulation analysis on ceramic gas turbine.** Mimaki, Toshio; Abe, Toshio; Hisamatsu, Toru; Hamamatsu, Teruhide; Ishikawa, Hiroshi; Wada, Katsuo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Aug 1987. 67p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756469/JAW.

In the application of ceramics to gas turbine materials, the analysis and estimation of thermal stress and careful strength verification were required at the trip on a gas turbine subjected to sudden thermal shock, therefore by the simulation on 20MW class gas turbine for coal gasification, the quantity change of state of gas in a gas turbine inlet at the trip was studied, and a effective operation method to reduce the thermal shock was investigated. Since the smoothing of temperature gradient and the sudden reduction of high temperature gas flow were considered to be most effective for the thermal stress reduction of ceramics materials, the operation methods of a fuel stop valve, blow off valve at a compressor outlet and compressor inlet guide vane were investigated. As a result of the simulation, the method to rapidly reduce working gas flow by simultaneous control of the compressor inlet guide vane and blow-off valve was recommended as the most suitable method at present. (25 figs, 6 tabs, 2 refs)

19179 **(CRIE-W—87019) Gas turbine research facility for coal gasification combined cycle power generation system. Outline of research facility.** Sato, Mikio; Ninomiya, Toru; Hisamatsu, Toru; Nakada, Toshihiko. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 44p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756472/JAW.

A gas turbine research facility for coal derived gaseous fuel has been constructed in Central Research Institute of Electric Power Industry in order to develop gas turbine technology in coal gasification combined cycle power generation system. In order to produce almost same gaseous fuel as actual coal derived gaseous fuel, this facility is made up of a fuel reformer to produce CO and H_2 from LPG, CO_2 and steam; hydrogen separating unit; and NH_3 supplying unit and so on. The production capacity of the facility is 6000 Nm^3/h gaseous fuel with calorific value of 1000 K cal/Nm^3. Two kinds of combustion test units for high pressure test and atmospheric pressure test with each capacity of 150,000 KW are installed, and an air compressor with delivery pressure of 19.7 ata, flow rate of 17,000 Nm^3/h is equipped. As the results of performance tests, the possibility of the testing gas of different calorific value and fuel composition was confirmed. (18 figs, 8 tabs, 3 photos)

19180 **(CRIE-W—87023) Characteristics of a 2T/D pressurized two stage entrained-bed coal gasifier. Comparison of various kind of coal's gasifying characteristics.** Takahashi, Shuichi; Inumaru, Jun; Hara, Saburo; Hamamatsu, Teruhide; Abe, Toshio; Ishikawa, Hiroshi; Takekawa, Toshiyuki; Ishigami, Shigeyasu. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1988. 34p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756474/JAW.

In order to elucidate the different of gasifying characteristics of the different of coals, an experemental study was performed using six kinds of coal, including domestic and overseas coal, on a 2 t/d pressurized two stage entrained-bed type coal gasifier. The standard fixed carbon conversion efficiency is proposed as an index which indicate the gasification efficiency, since volatile components in refined char composite are of small amount less than 5 %. Consequently, it is possible to eliminate the difference of fuel ratio (i.e. ratio of fixed carbon to volatile component) of coal. Because fixed carbon conversion efficiency of five kinds of experimental coal, except Canadian coal, were almost same in this experimental data, product gas rate, product gas calorific value and cold gas efficiency could be estimated by calculation from gasifiying conditions such as secondary air rate and charged quantity and characteristics of coal and recycling char. Coincidence between calculation and test results were observed in the product gas rate especially and product gas calorific value; calculation results of the latter was approximately 5% higher than test results. (17 figs, 3 tabs, 2 refs)

19181 **(DOE/PC/88935—T1) Inhibition of retrogressive reactions in coal/petroleum co-processing, September 1--November 30, 1988.** Schobert, H.H.; Tomic, J. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). Dec 1988. Contract FG22-88PC88935. 32p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007091/JAW.

The overall objective of this project is to develop a fundamental understanding of the reactions occurring at the onset of coke formation during the co-processing of coals with petroleum residua. The specific objectives include the examination of chemical components, or groups of components, in coals and petroleum feedstocks to quantify and rank the effects of these components on retardation or enhancement of coke formation. The work involves bench scale reactions in microautoclaves supplemented by optical microscopy of carbonaceous residues and instrumental analyses such as FTIR and ^{13}C NMR. During this reporting period the candidate coals have been selected, samples of the coals have been obtained, and a wealth of analytical data on the coals has also been obtained. 1 tab.

19182 **(SAIC—87/1611) Neutron activation mass flow rate meter for coal liquefaction: Final report.** Bernatowicz, H.; Gozani, T.; Wolff, S. (Science Applications International Corp., Palo Alto, CA (USA)). Mar 1987. Contract AC22-81PC40022. 158p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006165/JAW.

The feasibility of measuring the mass flow rates of two-phase process streams within a solvent refined coal facility using the pulsed neutron activation tracer technique was demonstrated. A laboratory setup comprising a pulsed 14 MeV neutron generator and a gamma detector for velocity and density determination was tested. Precision between 1 and 2% relative was obtained with various fluids designed to simulate the plant conditions. The fluids included: water, sucrose, carboxymethylcellulose solutions, n-decanol and coal-solvent slurries. Various mathematical models were prepared and tested for determining the average flow velocity. Particular attention was given to accurately measuring the velocity for laminar, non-Newtonian flow. A prototype instrument based on this technique was designed for the Wilsonville SCR pilot plant. Mechanical drawings were prepared for subsequent detailing and construction. 23 refs., 22 figs., 18 tabs.

19183 **Method for increasing steam decomposition in a coal gasification process.** Wilson, M.W. (to Dept. of Energy, Washington, DC). US Patent 4,786,291. 22 Nov 1988. Filed date 23 Mar 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for the gasification of coal in the presence of steam and a combustion supporting medium at a temperature less than about 2300°F, comprising the steps of heating coal in a gasifier in the presence of a combustion supporting medium and steam to a temperature less than about 2300°F and sufficient to effect gasification of the coal and thermal decomposition of a first portion of the steam for producing oxygen and hydrogen, and introducing a sufficient amount of sulfuric acid as a water splitting agent into the gasifier for the thermochemical decomposition thereof while thermally decomposing the first portion of the steam for increasing by a factor of at least two the percent of steam thermally decomposable in the gasifier without the introduction of the sulfuric acid.

19184 **Interactive chemistry of coal-oil reactions using model systems.** Kim, H.; Curtis, C.W. (Dept. of Chemical Engineering, Auburn Univ., AL (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

The coprocessing of coal with petroleum residuum has been shown to be a feasible process for simultaneously converting coal and upgrading coal liquids and petroleum residuum into higher quality products. The feed materials, coal and petroleum, are composed of such complex and diverse materials that the chemistry and reaction mechanisms involved in coprocessing are not well-understood. This study investigates the interactive chemistry between model hydrocarbon and heteroatomic species representative of those present in coal-oil reactions under both thermal and catalytic reaction conditions. The model reactant systems were composed of hydrocarbons, partially saturated aromatic hydrocarbons and heteroatomic compounds containing either nitrogen, sulfur, or oxygen. In this investigation, reaction conditions similar to those used in coprocessing were selected. Mo naphthenate was introduced as an oil-soluble catalyst precursor. The active catalytic species was generated in situ in the presence of excess sulfur. The reaction pathways for hydrogenation and heteroatom removal of different representative species have been proposed. In addition, the effect of excess sulfur in both thermal and catalytic reactions has been examined.

19185 **Recent developments in coal liquefaction at Wilsonville.** Lee, J.M.; Davies, O.L.; Pinkston, T.E. (Advanced Coal Liquefaction R and D Facility, Southern Electric International Inc., Wilsonville, AL (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

Two close-coupled integrated runs were completed during the past year at the Advanced Coal Liquefaction R and D Facility at Wilsonville, Alabama processing high ash Illinois No. 6 and low ash Ohio No. 6 bituminous coals in the catalytic-catalytic mode of operation. Shell 317 catalyst (bimodal NiMo) was used for both reactors and catalyst performance is compared with Amocat 1A and 1C catalysts used for previous runs in terms of distillate yields, catalyst deactivation and replacement rates. The effects of low ash feed coal, high resid recycle and high second stage reaction temperature on process performance are discussed. Catalyst replacement rates for the "all-distillate" product slate are projected as a function of the second stage reaction temperature and system space velocity. Aspects of optimum and cascading catalyst requirements are presented. Finally, results from the two-stage liquefaction process configuration comparison study are discussed in relation to distillate production and process economics.

19186 **Donor hydrogen depletion in coal liquefaction.** Burke, F.P.; Winschel, R.A. (Consolidation Coal Co., Research and Development, 4000 Brownsville Road, Library, PA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

A /sup 1/H-NMR method is presented that provides a measurement of the loss in donor hydrogen of a solvent during coal liquefaction. The method is fast and relatively simple to perform. It relies on several assumptions that limit the scope of its application. Nevertheless, within these limitations, the method is found to give comparable results to much more complex compositional analyses. Several applications of the method to batch and continuous liquefaction experiments are presented. One of the applications presented demonstrates the relation of coal conversion with donor depletion. Another includes a discussion of the isomerization of hydroaromatics to indan-like compounds at liquefaction conditions, which reduces the donor capacity of a solvent. Last, the importance of maintaining solvent donor hydrogen to the performance of liquefaction at SRC-like conditions is demonstrated.

19187 **Comparative rates of generation and combustion of coal volatiles.** Shaw, D.W.; Misra, M.K.; Essenhigh, R.H. (The Ohio State Univ., Dept. of Mechanical Engineering, 206 West Eighteenth Avenue, Columbus, OH (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

The pyrolysis and VM combustion for a single particle in a heated field have been modeled to test the single particle analysis and thin flame model commonly used for p.c. flames. Calculations show that the thin flame assumption is good except at very early and late stages of pyrolysis and that the single particle analysis is valid for normal flames. Comparison of pyrolysis times and VM combustion times also shows that the two processes occur on the same time scale.

0105 By-products

REFER ALSO TO CITATION(S) 19173, 19298

19188 **(CU/CPE—1981) Preparation of activated carbon from sub-bituminous Alberta coals. Final report.** Tollefson, E.L.; Hall, E.S. (Calgary Univ., AB (Canada). Dept. of Chemical and Petroleum Engineering). 1981. Vp. (CE—02422). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Conditions required for preparation of granular activated carbon, suitable for water treatment, have been investigated using subbituminous Alberta coals as a raw material. Activation parameters examined include: preoxidation time and temperature, and steam activation time. Parameters used to monitor the activation process included steam conversion, gasification rates, yield, ash content, porosity, and pore size distribution. Sorption numbers in addition to specific surface areas were used as measures of product quality. Limited comparative studies of the effects of coal rank were also done. Comparison of the 4 coals tested reveals large differences not only in reactivity but also in quality of carbons produced, thus establishing choice of coal source as an important parameter in production of activated carbon. It was found that higher quality products were obtained in better yield when the mildest conditions at which the steam-carbon reaction occurs were chosen. A compromise was found to be necessary between maximizing product quality and minimizing activation times. Steam activation times required for best product obtainable at a given temperature were different for each coal studied. Kinetic data obtained for the activation process also relate to possible production of fuel gases from coals. It was also found that neither thermal nor oxidative pretreatment conditions would improve carbon quality. Specific surface area and particle size do not completely define the value of a given activated carbon for a particular usage. Low ash content in starting material is a factor in production of higher quality carbons. 11 refs., 35 figs., 9 tabs.

19189 **Gas turbine coal-water slurry fuel specification development.** Caraker, K.W.; Vaught, J.M. (Allison Gas Turbine Div., General Motors Corp., P.O. Box 420, Indianapolis, IN (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

Chemical and physical characteristics of coal-water slurry fuels are major factors in determining the operating conditions and emissions from a gas turbine engine using this fuel. Engine operating modes and internal hardware require removal of specific coal ash constituents. Under U.S. DOE-METC contract, such a gas turbine engine and its specification for an ultraclean coal-water slurry fuel are presently being developed concurrently at Allison. Specification development has been made possible through interaction and development efforts with fuel suppliers. Test results from slurry atomization studies, bench scale combustion and an evaluation of deposition, erosion and corrosion effects have been used to provide

a target coal-water slurry fuel specification for future engine testing. High volatile content, above 35 dry wt. percent, and small coal particle size, 3-5 micron mass mean diameter, are required to promote rapid burning. Emission requirements mandate low ash and sulfur content. Initial deposition, erosion, and corrosion studies, prescribe ash mineral composition and desired fusion temperatures. Critical ash constituents known to be detrimental to engine components are listed. Slurry rheology has been found to be an important driver in fuel atomization, leading to improved combustion efficiency. The target specifications provided will be used to procure fuel for later full scale testing and will be refined for future Proof-of-Concept engine demonstration and eventual coal-fired gas turbine engine commercialization. Full scale production facilities will be needed to supply this type of fuel at competitive prices for future development into the 1990s.

0106 Properties

REFER ALSO TO CITATION(S) 19165, 19166, 19181, 19187, 19213, 19219, 19931

19190 **(DOE/PC/80911—T9) Linkages and aromatic clusters in a bituminous coal: Final report, September 1, 1985--September 30, 1988.** Chung, K.E. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Oct 1988. Contract FG22-85PC80911. 38p. (SC—5438.FR). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89001983/JAW.

The distribution and arrangement of aromatic clusters, oxygen functional groups, and linkages in an Illinois No. 6 bituminous coal were determined by controlled solubilization of the coal, followed by solvent fractionation of the soluble product and detailed analyses of the product fractions. The solubilization was carried out in reactions with NaOH/ethanol/H_2O at temperatures of 260{degree}, 300{degree} and 320{degree}C. Elemental balance and spectroscopic data revealed that the oxygen functional groups of the coal were attacked selectively in the solubilization process, resulting in an orderly definable diminution of the complex coal structure. Also aliphatic linkages present in selected solubilized product fractions were subjected to a transalkylation reaction. A molecular structural model specific to the Illinois coal was constructed, and the hydroliquefaction behavior of the coal was evaluated in terms of potential product distribution and hydrogen consumption. The structural characteristics are compared with those of a Wyoming subbituminous coal in our previous study. 9 refs., 16 figs., 11 tabs.

19191 **(FRNC-TH—3407) Separation and characterization of coal macerals.** Totino, E. (Metz Univ., 57 (France)). 1986. 253p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756984/JAW.

A separation technique of coal macerals by centrifugation with a density gradient is developed. Fractions are analysed by laser spectroscopy, Fourier transform infra-red analysis C13 nuclear magnetic resonance and electron spin resonance. Importance of comminution of samples is underlined. Influence of oxidation on thermoplastic properties of coals is studied.

19192 **(NP—9770268) Water vapour regeneration of activated carbon. A contribution to reducing pollutants to below the environmentally relevant level.** Minelli Figueira, M.E. (Kaiserslautern Univ. (Germany, F.R.). Fachbereich Maschinenwesen). 5 Aug 1987. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770268/JAW.

The aim of this study was to work out fundamentals for the development of an improved process for steam regeneration in activated carbon plants which are to be used for the removal of vaporous organic pollutants of up to environmentally relevant concentrations. For this purpose, a test set-up for the determination of the adsorption and desorption equilibria of steam in the temperature range of 100 to 150/sup 0/C and a plant for the measurement of the adsorption and desorption kinetics of 55 mm and 110 mm thick activated carbon layers, were developed. Toluene was used as a model compound for an organic pollutant. After preheating the coal to 125/sup 0/C (for the prevention of pore condensation) and desorbing with 6 kg steam/kg adsorbed solvent, the pollutant emission concentration could be kept at $<$ 1 mg/m/sup 3/ over a time of $\approx$ 240 minutes with an entry concentration of 2 g/m/sup 3/ provided that a superheating to 150/sup 0/C in a 110 mm thick coal layer took place. The experimental results were used as input for a computer model for estimating the break-through curves for a technical layer thickness of 1 m.

19193 **(SVF—309) Repeatability and reproducibility of the determination of sulfur in coals with low sulfur concentration.** Berglund, K.; Maansson, M.; Lundgren, B. (Statens Provningsanstalt, Boraes (Sweden)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); Statens Provningsanstalt, Boraes (Sweden)). Aug 1988. 47p. (In Swedish). (SP—1988-13). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757104/JAW.

An interlaboratory test (Round Robin) has been conducted to evaluate the precision of an instrumental method - ASTM D 4239-C - for the determination of sulphur in coals. Seven laboratories participated in the Round Robin and six samples of coal with sulphur contents from 0.2 to slightly more than 0.8% were included in the study. The coals were selected to cover typical variations in composition and character. Based on the results of the Round Robin a repeatability interval can be defined that is less than half of that in the ASTM standard, valid for sulphur contents to about 1%. This satisfies the first of the precision requirements. - When the sulphur is primarily pyritic it tends to be unevenly distributed also in the finely ground analysis sample. As the amount of sample for an analysis is rather small this type of inhomogeneity may effect the repeatability negatively. Significant improvement of the reproducibility, compared to the ASTM standard, has only been achieved at the lowest concentrations, below ca 0.5% sulphur. As the instrumental method is empirical, one relies on comparisons with samples of known sulphur content. Thus the quality of the reference materials used for calibrations determines the reliability of the results obtained. The availability of certified reference materials for sulphur in coal at levels below 1% is limited and none of the Round Robin participants complied with the requirements of the ASTM standard as to reference materials. The results show that the limiting factor in efforts to achieve acceptable reproducibility at low sulphur levels is the inadequacy of the reference materials. (authors).

19194 **Prediction of coal hydrophobicity.** Labuschangne, B.C.J.; Wheelock, T.D.; Guo, R.K.; David, H.T.; Markuszewski, R. (Div. of Energy Technology, CSIR, Pretoria 0001 (SA); Dept. of Chemical Engineering, Iowa State Univ., Ames, IA (US); Engineering Research Institute and Statistical Lab., Iowa State Univ., Ames, IA (US); Ames Lab., Iowa State Univ., Ames, IA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

A statistical analysis of previously published data, as well as newly acquired data, shows that coal hydrophobicity correlates better with moisture content than with carbon content, and better with the moisture/carbon molar ratio than with the hydrogen/carbon or oxygen/carbon atomic ratios. These findings indicate that there is a strong association between hydrophobicity and coal moisture content.

0108 Waste Management

REFER ALSO TO CITATION(S) 19189, 19555, 20503

19195 **(CC—8612) Assessment of the treatability of coal liquefaction process condensate.** (CANVIRO Consultants (Canada)). 1986. 262p. (CE—02315). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The overall objective of this research was to define the practical operational constraints associated with treatment of condensates from the H-Coal process. Specific tasks included assessment of

the efficacy of various solvents under batch and continuous flow conditions for removal of phenolic compounds from the condensates. The experimental program focussed on the evaluation of pretreatment technologies applicable to process the condensates and the assessment of the capabilities of the biological fluidized bed process to achieve nitrogen removal from condensates which had undergone varying degrees of pretreatment and/or dilution. Wastewater from the H-coal plant in Kentucky was used for the pretreatment assessments and the biological treatment investigations. The principal conclusions which can be drawn from the investigations include the following. Solvent extraction was demonstrated to be a practical approach for pretreatment of the condensates. 2-octanone was found to be a superior solvent to others tested in terms of its relative affinity for total and specific phenolic compounds present in the condensates. The coupled biological fluidized bed process was demonstrated to be capable of achieving up to 90 percent removal of carbonaceous and nitrogenous contaminants from the condensates with appropriate pretreatment and dilution. The maximum specific denitrification rate achievable increased at higher levels of dilution for a specific condensate type. Denitrification was relatively insensitive to the severity of pretreatment applied to the condensate and to the degree of dilution applied. Anaerobic pretreatment of the condensate was demonstrated to be a potential alternative to conventional solvent extraction. 37 refs., 24 figs., 54 tabs.

19196 **(CONF-880604—15) Modeling of agglomeration in a fluidized bed.** Rehmat, A.; Huang, C.; Carty, R.; Hariri, H.; Arastoopour, H. (Institute of Gas Technology, Chicago, IL (USA)). 1988. Contract AC21-87MC23283. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007171/JAW.

From Joint meeting of the 195th national meeting of the American Chemical Society and the 3rd Chemical Congress of North America; Toronto, Canada (5 Jun 1988).

A fluidized bed containing a central jet was operated with low-temperature melting materials to obtain the rate of agglomeration as well as to measure the temperature distribution within the fluidized bed. The rate of agglomeration was obtained as a function of operating parameters such as temperature and velocity. The agglomeration rate defined, as the rate of change in the number of particles of a particular size, was determined from the particle population balance using the experimental data. The agglomeration model developed to predict the agglomeration rate constant based on the temperature distribution in the fluidized bed and the rate of entrainment of particles into the jet yielded values for the rate constants similar to the experimental values. 9 refs., 4 figs.

19197 **(DOE/MC/20107—2623) Development of acoustic agglomerator: Final report.** (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Nov 1987. Contract AC21-84MC20107. 159p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010284/JAW.

The Aerojet Energy Conversion Company has conducted a program to develop a system for removal of particulates from a hot gas stream. The system was based on acoustic agglomeration, and it had to be suitable for cleaning the effluent gas stream from a coal-burning, pressurized fluid bed combustor (PFBC). The hot gas cleanup system with acoustic agglomeration (HGCU AA) used high intensity acoustic waves to pre-condition the hot aerosol by causing the smaller particles to agglomerate, or form clusters, with the larger particles. Conventional cyclones can then be used to remove the particulate matter from the aerosol more effectively since the smaller particles have, in effect, been "removed" by their agglomerating with the larger particles. After agglomerating and becoming larger, the particles can be more effectively removed by cyclones. 14 refs., 61 figs., 14 tabs.

19198 **(DOE/PC/91021—T7) Flue gas cleanup technology utilizing energetic electrons: Progress report No. 8-9, February 6, 1988--August 5, 1988.** Davis, R.H.; Finney, W.C. (ed.). (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1988. Contract AC22-86PC91021. 58p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008078/JAW.

This report covers Quarters 8 and 9 (February 6, 1988--August 5, 1988). During this period, extensive experimentation was carried out under Task A, the Optimization of Electron Beam Precharger Geometry. Concurrently, new experiments were performed on free electron charging which essentially completed the work called for under Task B. The progress on both Tasks is briefly summarized in this section and is discussed in detail in the following sections. 24 figs., 3 tabs.

19199 **(EPRI-GS—6208-Vol.2) Seventh particulate control symposium: Volumes 2, Particulate/SO_2 control with fabric filters: Proceedings.** (Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Research Triangle Park, NC (USA)). Feb 1989. 532p. (CONF-880305—Vol.2). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008055/JAW.

From 7. symposium on the transfer and utilization of particulate control technology; Nashville, TN, USA (22 Mar 1988).

The objectives of the Symposium were to encourage the exchange of new knowledge in the particulate control field among designers, users, and researchers, and to stimulate new ideas that will lead to further technological improvements in the future. Fabric filters and electrostatic precipitators were the major topics, but novel concepts and advanced technologies were also explored. Topics discussed include: Particulate Control for Incinerators; Dust Properties; Full-Scale Fabric Filter Studies; Power Supplies and Controls for Precipitators; Advanced SO_2/Particulate Control Studies; Precipitator Performance Evaluation and Upgrading; Fabric Filter Pilot-Scale Studies; and Precipitator Modeling. Individual projects are processed separately for the data bases.

19200 **Lignosulfonate-modified calcium hydroxide for SO/sub 2/ control during furnace injection.** Kirchgessner, D.A.; Lorrain, J.M. (to US Environmental Protection Agency, Washington, DC). US Patent 4,786,485. 22 Nov 1988. Filed date 12 Nov 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for removing sulfur oxide sulfur oxide-containing gases from exhaust gases of a fossil fuel-fired combustor comprising the step of introducing into the exhaust gases solid particles capable of reacting with the sulfur oxide-containing gases, the particles comprising a surface-modified sorbent selected from the group consisting of alkali metal lignosulfonate-modified calcium hydroxide and alkali metal lignosulfonate-modified calcium magnesium hydroxide, wherein the alkali metal lignosulfonate comprises up to 5% by weight of the total dry weight of the surface-modified sorbent.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 20541

19201 **(DOE/ER/60263—T1) Spot assisted analysis and modeling of contaminant discharge from disturbed lands: Final report, July 1, 1984--January 31, 1988.** Gardner, T.W.; Petersen, G.W. (Pennsylvania State Univ., University Park (USA). Environmental Resources Research Inst.). Feb 1988. Contract FG02-84ER60263. 32p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008105/JAW.

This report describes research to identify, explore, and hypothesize scientific questions related to the hydrologic cycle and to hydrologic/ecologic interactions. Research was initiated in three distinct climate zones (humid, arid, and arctic) during various times within the project period. The REFLEX experiments are being conducted within different climates/ecologic zones in an effort to explore the limits and benefits of advanced remote sensing technology. Research on disturbed watersheds in humid climates explores and identifies the fundamental hydrologic and sediment transport relationships in the temporal evolution of the hydrologic cycle on disturbed watersheds. Characterization of runoff properties of disturbed watersheds achieves greater than 70 percent classification accuracy with high resolution, digital SPOT data. Research on disturbed watersheds in arid regions addresses the problem of remotely sensed data as input to hydrologic models. It explores the utility of high resolution satellite data and registered, multiple data layers as input to hydrologic models. This research produced a significant advancement in automated delineation and extraction of drainage

networks, watershed divides, and contributing areas from digital elevation databases. 33 refs., 5 figs., 1 tab.

19202 **(EC—8310) OECD round table on coal and the environment. Canadian discussion paper.** (Environment Canada, Ottawa, Ontario). 1983. 65p. (CE—02371). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document was prepared as a discussion paper for a 1983 OECD round table on coal and the environment. Background information is provided on Canada's coal development history and future. The extent and distribution of Canada's coal resources and reserves are examined, and production capability and market factors are discussed within the context of Canada's regional diversity. The major environmental issues related to coal are then addressed. Unresolved problems include long-range transport of airborne pollutants, trace element emissions, water availability and quality, health and safety, community impacts, and carbon dioxide loading. Finally, options are presented for resolving conflicts between the use of coal and the quality of the environment. Regulatory, technical, and advocacy approaches are discussed. The importance of advocacy and institutional liaison as a component of Canada's approach in this area is noted. 9 figs., 7 tabs.

0110 Reserves And Exploration

19203 **(AU/G—8103) Structure of the coal-bearing and adjacent strata near Cadomin, Alberta.** Charlesworth, H.A.K. (Alberta Univ., Edmonton, AB (Canada). Dept. of Geology). 1981. 163p. (CE—02432). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents research findings on the structure and stratigraphy of the coal-bearing and adjacent strata near Cadomin, Alberta. The findings from such research were felt to have potential benefits for the Alberta coal mining industry in general, and not just for mining companies in the Cadomin area. The first part of the report describes the five units comprising the Luscar Group near Cadomin, their stratigraphy and lithology. The second describes the structure of the coal-bearing and adjacent strata near Cadomin, which are interpreted as occurring in three structural units, each of which came into existence at a different time during orogenesis. The third part, reporting on the stratigraphy of the Luscar Group in the west-central Alberta Foothills, suggests that some coal seams in the Group may be much more widespread than formerly thought. One method of correlating seams is proposed. The fourth part, examining the structural style of the Luscar Group of part three, suggests that 3 structural mechanisms were dominant during deformation of the Group: low-angle thrusting, and flexural-slip and kink folding. The final parts describe an automated procedure for preparing structure contour and overburden thickness maps from outcrop data alone, and present a manual for a computer-based system for collecting, storing, editing, retrieving and processing certain data from outcrops and drillholes. Retrieved data can be used to plot maps showing locations of drillhole collars, intersected horizons, and outcrop structural data; plot orientation diagrams; and construct computer plots on which structural cross-sections can be drawn. 38 refs., 20 figs.

19204 **(NEDOJ—8704) Survey report of coal resources in India.** Kanai, Hisao. (New Energy and Industrial Technology Development Organization, Tokyo (Japan)). Mar 1987. 331p. (In Japanese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88756475/JAW.

This report summarizes the results of the survey and research which were conducted in FY 1986 by the Mitsubishi Consolidated Institute having been entrusted by NEDO. The survey was done as an survey work for facilitating the development of the basic infrastructure for importing overseas coal with the following objectives; (1) It is necessary to grasp the current situation of the existence of coal resources and the coal exporting capability of coal producing countries in order to realize the stable supply of coal which is important among the oil alternate energy, (2) For the above, the basic survey on the current situation and the future prospect of the exploitation of coal mines is conducted with regard to India which has the rich coal reserve and production in order to grasp the problematical points concerning the coal supply to Japan and arrange information for the future. In this report, the policy and legislation concerning coal of the Government of India, the current situation and the future prospect of coal supply, the current situation and the future prospect of coal transportation and the current situation and the future prospect of coal demand, etc. are summarized and the possibility of coal exportation is evaluated. (13 figs, 162 tabs)

0120 Mining

REFER ALSO TO CITATION(S) 19204

19205 **(CANMET—8301) Longwall demonstration in western Canadian coals. Phase 1, mine planning & systems engineering. Executive summary.** (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1983. 120p. (CE—02372). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Recent technological advances have enabled longwall mining installations to operate successfully in seams up to 16 ft thick, inclined at up to 70 degrees. Successful introduction of this technology into Canada has been suggested as being of substantial benefit to Canada and its coal industry. An area of mineable coal at the Smoky River 9G Mine in Alberta has been identified as being suitable for a demonstration of longwall techniques, and a feasibility study of such a demonstration project is presented in this report. The report oulines the development of the Smoky River operation, provides data on regional geology and coal reserves, describes current operations and presents a detailed engineering study concerning recovery of coal reserves at a suitable part of the 9G Mine. Technical findings of this study show that, in terms of geological and geotechnical parameters, there are no significant barriers to the successful application of longwall in the target area. Detailed consideration of the reserves has shown that an appropriate layout for longwall mining can be designed, and that the development work can be undertaken with existing equipment and systems. A machine capable of driving development headings in the more steeply inclined areas of the mine has been identified. Production performance calculations indicate productivity would average 26 tons of raw coal per man-shift. Economic analysis shows cost for producing and transporting coal to a mine-mouth stockpile would be $35.97/ton in the first year, declining to $14.08 in the 5th year. At a market price of $87.50/ton, the longwall demonstration would provide a positive cash flow. 30 figs., 22 tabs.

19206 **(CMRC—81/22-T) Development of the base friction modelling technique as a visual tool for mine safety instruction.** Stimpson, B. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). 1981. 32p. (CE—02431). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the theory, development, and practice of base friction modelling as applied to coal mining. This simple physical modelling procedure permits the rapid construction and testing of two-dimensional models of excavations in complexly jointed rock masses, and has been used to demonstrate mechanisms of slope failure, caving, and tunnel roof collapse. In particular, a tiltable model frame and a new, brittle, inexpensive model material made from flour considerably extend the ability of the procedure to model more realistically than heretofore. Three unedited films were prepared to illustrate the ability of the modelling technique to simulate roof movement and collapse above a single rectangular opening in jointed strata. The 16 mm film (color, 8 min. duration) shows the progressive collapse of strata comprising four beds with differing joint patterns. The two 8 mm films (black and white, 3.5 and 1.5 min. duration) demonstrate the behaviour of a horizontally bedded roof in strata of two different bed thicknesses as the span of the opening is increased. It is suggested that the base friction modelling technique could be used to develop films (complemented by scripts and manuals) for illustrating and providing instruction on important

aspects of strata behaviour in underground coal mining, including roof and pillar stability, caving, and floor heave, to persons with little or no knowledge of rock mechanics and strata control. 12 refs., 5 figs.

19207 **(CMRC—82/16T) Progress in the mining technology research program of the Coal Mining Research Centre, Alberta.** Barron, K. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). 1982. 21p. (CONF-8210119—; CE—02413). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From 6. international conference on coal research; London, UK (4 Oct 1982).

The Coal Mining Research Centre was formed in Alberta in 1977 to perform applied research in coal mining and preparation. Progress in developing staff and facilities for the Centre is briefly outlined. Highlights of research activities are reported in the Centre's Mining Technology Program. These highlights include the publication of a geophysical borehole logging handbook for coal exploration, studies valuating selective materials handling systems for overburden removal and placement in the spoil pile, research into the use of infrared and vibration measuring devices as maintenance tools, the computer simulation of underground mining systems, and the development of an analytical technique for the design of coal pillars. 13 refs., 6 figs., 2 tabs.

19208 **(DOE/EIA—0121(88/3Q)) Quarterly coal report: July--September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 14 Feb 1989. 135p. NTIS, PC A07/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89007344/JAW.

The Quarterly Coal Report provides comprehensive information about US coal production, exports, imports, receipts, consumption, and stocks to a wide audience, including Congress, federal and state agencies, the coal industry, and the general public. The data presented in this report are collected and published by the Energy Information Administration (EIA) to fulfill data collection and dissemination responsibilities. This issue presents detailed quarterly data for July through September 1988, year to date data, aggregated quarterly historical and projected data for 1980 through 1990, and aggregated annual historical and projected data for 1960 through 2000. Appendix C displays, from 1980 on, detailed quarterly historical coal imports data. Appendix D gives selected quarterly tables converted to metric tons. To provide a complete picture of coal supply and demand in the United States, historical information and forecasts have been integrated in this report. 15 figs., 70 tabs.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 19204, 19931

19209 **(CONF-8809292—) Virginia ports: Expanding Appalachian coal's horizons.** (Virginia Coal Council, Richlands (USA)). 1988. Contract FG01-88FE61637. 207p. NTIS, PC A10 - OSTI. Order Number DE89007412/JAW.

From Virginia ports: expanding Appalachian coal's horizons; Norfolk, VA, USA (13 Sep 1988).

Discussions from a conference on coal, on various aspects of the coal industry, are presented. (CBS)

0140 Combustion

REFER ALSO TO CITATION(S) 19169, 19189, 19197, 20329, 20332, 21567

19210 **(ANL/PPRNT—89-176) Hydrodynamics of fluidization: Time-averaged and instantaneous porosity distributions in a fluidized bed with an immersed obstacle.** Bouillard, J.X.; Lyczkowski, R.W.; Gidaspow, D.; Berry, G.F. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 43p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008474/JAW.

Erosion in bubbling fluidized-bed combustors is a serious issue that may affect their reliability and economics. Available evidence suggests that the key to understanding this erosion is detailed knowledge of the coupled and complex phenomena of solids circulation and bubble motion. A thin "two-dimensional" rectangular fluidized bed with an obstacle served as a rough model for a fluidized-bed combustor. This model was studied experimentally and computationally using two hydrodynamic equation sets. The computed hydrodynamic results agree reasonably well with experimental data. Bubble frequencies compare well with those obtained from a high speed motion picture study. Time-averaged porosities computed from both models agree with time-averaged porosity distributions measured with a gamma-ray densitometer. 46 refs., 13 figs., 2 tabs.

19211 **(CONF-890215—2) Effects of a reactive element on the response of oxide scales to energetic impact.** Tortorelli, P.F.; Kachidza, J.M.; Keiser, J.R. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007819/JAW.

From Fall meeting of the Metallurgical Society; Las Vegas, NV, USA (27 Feb 1989).

The mechanical response of preformed oxide scales on NiCrAlY alloys to energetic particle bombardment was used to test a model in which the reactive element addition (Y) improves scale adherence by increasing the resistance of the oxide to cracking (toughening). The yttrium was definitely observed to suppress scale spallation as its concentration in the base Ni-20Cr-12Al(wt %) alloy was increased. However, room temperature single particle impacts induced cracking of the aluminum-rich scales regardless of the yttrium concentration of the target alloy. The results, therefore, did not support a scale toughening model for the effect of this reactive element on scale adherence. There was some evidence that there may have been a beneficial influence of yttrium on the cracking resistance of some chromia-enriched scales. 16 refs., 9 figs., 1 tab.

19212 **(EPRI-CS—5831-Vol.2) Colorado-Ute's Nucla circulating AFBC demonstration project: Volume 2, Plant equipment and systems design: Final report.** Blunden, W.E. (Electric Power Research Inst., Palo Alto, CA (USA); United Engineers and Constructors, Inc., Denver, CO (USA). Stearns-Roger Div.). Feb 1989. 181p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008410/JAW.

This is the second volume of two reports documenting the conversion, life extension and capacity upgrade of Colorado-Ute Electric Association's Nucla Station from stoker-firing to atmospheric fluidized-bed combustion (AFBC). This particular report describes the plant equipment and system design for the first US utility size circulating AFBC boiler and its ancillary systems. The purpose of these reports is to share the information gathered during the Nucla circulating AFBC demonstration project and present it so that other utilities can evaluate the technical feasibility and cost effectiveness of replacing pulverized or stoker-fired boiler units with circulating fluidized-bed boiler units. To this end, each volume presents material concerning a different aspect of the Nucla circulating AFBC demonstration project. Volume 1 of this report (EPRI CS-5831) covers the project origin, rationale, organization, planning and financing, and circulating AFBC boiler design development. 8 figs., 12 tabs.

19213 **(EPRI-GS—6118) Proceedings: 1988 seminar on fluidized-bed combustion technology for utility applications.** (Electric Power Research Inst., Palo Alto, CA (USA); Bechtel Corp., San Francisco, CA (USA)). Feb 1989. 883p. (CONF-880550—). Research Reports Center, Box 50490, Palo Alto, CA 94303.

From Fluidized-bed combustion technology for utility applications seminar; Palo Alto, CA, USA (3 May 1988).

This EPRI-sponsored seminar was organized to review recent technical and market developments related to AFBC and PFBC steam generators suitable for utility applications. The focus of the seminar was on the operating experience gained at pilot and demonstration scale systems located around the world. The objective of the seminar was to assist electric utilities in planning, evaluating, building, and operating FBC power plants. The major topics

discussed were: operating experience from industrial AFBC and FBC pilot plants; updates on the three AFBC demonstrations and other AFBC and PFBC commercial projects; examination of critical FBC components including tube wastage and hot gas cleanup; recent plant designs and economic assessments; AFBC design specifications and bid evaluations. Individual projects are processed separately for the data bases.

19214 **(STEV-FBT—88-28) Partial gasification PFBC - KTH. Final report.** Boghammar, A.; Sjoestroem, K.; Wiktorsson, L.P. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Technology). (Statens Energiverk, Stockholm (Sweden); Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Technology). Nov 1988. 76p. (In Swedish). (KTH-KTR—88-28). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757076/JAW.

In the process described in literature the pyrolysis temperatures are between 815 and 870 deg C. The higher temperature limit is caused by increased alkali emission which leads to corrosion of the turbine blades. Sulphur is absorbed by dolomite or limestone in the pyrolysis bed. Desulphurization is about 90%, corresponding to emission levels of about 100 mg S/MJ fuel. The main reason for the relatively high emission levels is the organic sulphur in the tar fraction of the pyrolysis gas. Emission of sulphur can therefore be reduced substantially if the organic compounds in the pyrolysis gas are cracked. The reason for this is that sulphur is only absorbed on dolomite and limestone in the form of H/sub 2/S. It has been shown that half-calcined dolomite has the best sulphur absorbing capability. Dolomite has also been shown to have a tar cracking capability. This is of great importance when it comes to cracking the sulphur containing compounds in the tar. When reacting with H/sub 2/S the CaCO/sub 3/ is transformed into CaS, which has been suggested to also have tar cracking properties. Our suggestion is a process where the pyrolysis is carried through in a transport reactor. Coal and dolomite are fed to the reactor with the air needed for obtaining 870 deg C in the reactor. Mass and energy balances have not shown any theoretical problems in reaching the specified inlet temperature, 1200 deg C, for the gas turbine. After the pyrolyser a fixed dolomite-bed prolongs the contact time for better cracking of the sulphur containing organic compounds and for the absorption of H/sub 2/S. Through continuous discharge from the bottom of the bed, char and sulphided dolomite are transported to and fed into the PFBC-combustor where the CaS is transformed into CaSO/sub 4/. (With 30 refs, 5 appendices) (authors).

19215 **Development of a non-slagging vortex combustor (VC) for space/water heating applications.** Nieh, S.; Fu, T.T. (Catholic Univ. of America, Washington, DC (US); Naval Civil Engineering Lab., Port Hueneme, CA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

An innovative non-slagging vortex combustion (VC) technique burning ultrafine coal has recently been conceived and investigated for space/water heating applications for commercial and institutional buildings. This VC technique integrates many advantages from cyclone combustor, multistate combustion, pulverized coal-fired combustor, and fluidized bed combustion; while eliminates most of their inherent disadvantages. The vortex combustor is featured by dry ash removal (low combustion temperature), high combustion intensity and thermal reliable operation. This paper summarizes the results of thermodynamic analysis and system design of VC, cold flow tests in two VC models, combustion of ultrafine coal in the exploratory VC hot model, and mathematical modeling of gas-solid flows in vortex chambers.

19216 **Gas-reburning-sorbent injection for NO/sub x/ and SO/sub 2/ control.** Folsom, B.A.; Bartok, W.; Elbl, M.; Kurzynske, F.; Ritz, H. (Energy and Environmental Research Corp., Irvine, CA (US); State of Illinois, Springfield, IL (US); Gas Research Institute, Chicago, IL (US); Dept. of Energy, Pittsburgh, PA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

This paper discusses a field demonstration of gas reburning-sorbent injection for NO/sub x/ and SO/sub 2/ emission control on three coal fired utility boilers. NO/sub x/ and SO/sub 2/ emissions are thought to be responsible for acid rain deposition and the related environmental impacts. Coal fired steam electric units contribute to the NO/sub x/ and SO/sub 2/ emission inventory and have been targeted for retrofit control by draft legislation, especially the units erected prior to the promulgation of the New Source Performance Standards (pre-NSPS). A field test project has been initiated as part of the U.S. Department of Energy (DOE) Clean Coal Technology Program to demonstrate GR-SI on three pre-NSPS coal fired boilers in the State of Illinois. The Gas A dry calcium based sorbent can be injected into the burnout zone where it reacts with SO/sub 2/ to form calcium sulfate which may be recovered in the particulate control device (typically an electrostatic precipitator). Alternatively, the sorbent may be injected further downstream in the boiler, or in the flue gas duct upstream of the precipitator. The demonstration project involves three phases: design, construction and field evaluation. The design phase is now in progress. In the construction phase, the GR-SI systems will be retrofitted to steam electric units and in the field evaluation phase, one year tests will be conducted on each unit demonstrating emission control, performance improvement, environmental effects and cost effectiveness.

19217 **On-line, in situ particle measurements in large scale combustion systems.** Holve, D.J.; Meyer, P.L.; Munzio, L.J.; Shiomoto, G.H. (INSITEC, 2110 Omega Road, Suite F, San Ramon, CA (US); Fossil Energy Research Corp., 23342 O South Pointe, Laguna Hills, CA (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

A compact, optical probe (PCSV-P) was developed to provide on-line, in situ particle measurements in large scale combustors. Southern Company Services arranged for a demonstration of the probe at the Watson Power Plant. The PCSV-P was used to obtain measurements of particle concentration, size, and velocity in the furnace (1330°C) and at the inlet and outlet of the electrostatic precipitator. A comparison of optical probe velocities with measurements made by pitot tubes showed consistent trends in velocity values as function of position in the duct. Cascade impactor and optical probe results were in good agreement for particle sizes up to 4 - 10 microns. The optical probe measures higher particle concentrations at larger particle sizes. Differences in the large particle results are believed to be due differences in large particle characteristics (refractive index, density) and to differences in the way large particle information is measured and analyzed by the two techniques. Optical probe measurements showed that the greatest variation in the velocity and particle concentration occurred at the ESP exit. While the small particle count rate was steady, the large particle count rates varied by a factor of six. These fluctuations are indicate that processes such as rapping periodically release bursts of larger particulate. The most complex velocity flow field was also measured at the ESP exit.

19218 **Technical status of coal-fired mhd power generation.** Wu, Y.C.L.S.; Muehlhauser, J.W.; Johanson, N.R. (Engineering Research and Consulting, Inc. (US); The Univ. of Tennessee Space Institute, Tullahoma, TN (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

This paper presents a summary of the 1988 MHD Program Plan, the four procurements for the Proof-of-Concept Testing on: Integrated topping cycle; integrated bottoming cycle; seed regeneration/recovery; and retrofit conceptual design. In addition data obtained at the Component Development Integration Facility (CDIF), Coal Fired Flow Facility (CFFF) and other relevant results are presented.

19219 **An experimental investigation of mass transfer from single particles.** Ramezan, M.; Anderson, R.J.; Kale, S.R. (U.S. Dept. of Energy, Morgantown Energy Technology Center, Morgantown, WV (US); Mechanical and Aerospace Engineering Dept., West Virginia Univ., Morgantown, WV (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

The combustion of pulverized and micronized coal involves both mass and heat transfer to and from entrained particles. The extent of this mass transfer can affect the coal particle combustion rate, contaminant release and formation as well as product composition. This research project addressed the effectiveness of particle slip to enhance these mass transfer phenomena. The study utilized an electrodynamic balance to suspend single particles of various sizes in a well characterized air jet at ambient temperature and pressure. Solid, volatile particles (naphthalene) in the size range from 100-200 μm diameter were studied for conditions of both natural convection (no air jet) and forced convection with jet velocities up to 7.5 cm/s. The experimental technique allowed the particle mass change to be monitored throughout each test as the particle diameter decreased to below 10 μm. For natural convection, a time-averaged Sherwood number of about 1.75 was measured. The Sherwood number measured for forced convection was strongly dependent on Reynolds number and was substantially greater than the available value for a sphere of equivalent projected area. These results suggest that particle slip may be even more important than previously realized to control or enhance various coal combustion phenomena.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 19173, 19204, 19208, 19209, 19681, 20765

19220 **(CONF-8809248—7) Pacific rim coal trade: A US perspective.** Zuercher, R. (ed.). (East-West Center, Honolulu, HI (USA). Resource Systems Inst.). 1988. 14p. OSTI - East-West Center, Resource Systems Institute, 1777 East-West Road, Honolulu, HI 96822. Order Number TI89008133/JAW.

From Coal trade workshop: the dynamics of expanding supply; Honolulu, HI, USA (30 Sep 1988).

Coal exports of the USA and Asia are discussed. Constraints, positive developments, coking, and steam coal demands are addressed. (CBS)

0160 Health And Safety

REFER ALSO TO CITATION(S) 19206, 20764, 21567

19221 **(NP—9770279) Controlling burstprone areas in coal seams with seismoacoustical measurements. Final report.** Will, M.; Raekers, E.; Klockmann, W.; Ruecker, W. (Westfaelische Berggewerkschaftskasse, Bochum (Germany, F.R.). Inst. fuer Geophysik, Schwingungs- und Schalltechnik). (Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1988. 98p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770279/JAW.

The aims were to continue surface and underground measurements and mainly to develop a practically applicable seismoacoustic equipment together with evaluation techniques. Surface measurements were continued the whole time. Earlier found relationships to underground activities were confirmed. The data of underground seismoacoustical measurements allowed various extensive geophysical investigations. Their results were used for developing a new practically applicable seismoacoustic-device 'MESAS'. This device carries out pre-evalutions underground. Thus less data have to be transmitted and existing cables can be used. Out of collecting of mine data especially on-line-programs for determining locations and energy-release of seismic events have been realised in the device. Evaluations showed that areas of high stresses mostly have high event-rates and event-densities and especially high energy-release-densities. The new equipment therefore allows continuous control in space and time of burstprone areas complementary to test drillings. (orig./HP) With 23 refs., 21 figs.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 19204

02 PETROLEUM

19222 (NRC/ACGR—NRCC28003TM41, pp 433-453) **Summary of a presentation of the Norwegian Petroleum Directorate.** Steiro, V.; Storli, S. 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

The history of the Norwegian Petroleum Directorate is outlined and its functions are listed. Norwegian petroleum developments in the Norwegian Arctic region are also described. Onshore developments are limited to the Spitsbergen islands; to date, no commercial discoveries have been made, but there is exploration activity by Norwegian and Soviet operators. Increasing interest in this remote area is due to new geological models, and applicability of activities in the area for exploration in other areas. Offshore development in the Barents Sea began in 1980; several gas discoveries have been made, and there are indications of oil in a number of exploratory wells. 8 figs.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 19234, 19237, 20778, 20779

19223 **(CMI-R—30800-1) Selection of petroleum exploration strategies and a problem in stochastic portfolio optimization.** Tjoestheim, D.; Hefting, T. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Sep 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757040/JAW.

A constraint expressing risk aversion is introduced in an optimization problem concerning the allocation of limited resources among several possible oil prospects. It is shown how the resulting stochastic problem can be handled using density approximation and nonlinear optimization techniques. 16 refs., 1 fig.

19224 **(OCS/EIS/EA/MMS—89-0005) Gulf of Mexico sales 123 and 125: Central and western planning areas: Draft environmental impact statement.** (Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office). Mar 1989. 443p. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico, OCS Regional Office, New Orleans, Louisana. Order Number TI89008107/JAW.

This Environmental Impact Statement (EIS) addresses two proposed Federal actions that will offer for lease areas on the Gulf of Mexico Outer Continental Shelf (OCS) that may contain economically recoverable oil and gas resources. Proposed Central Gulf Lease Sale 123 is scheduled to be held in March 1990 and will offer all unleased acreage in the Central Planning Area (CPA). As of December 1988, this was approximately 6011 unleased blocks comprising about 32.1 million acres. This area includes acreage located from 3 to 220 miles offshore in water depths ranging from 4 to 3425 m. There are no areas deferred from the proposed action, but there are alternatives to the proposed action and proposed mitigating measures available for adoption as described below. Proposed Western Gulf Lease Sale 125 is scheduled to be held in August 1990 and will offer all unleased acreage in the Western Planning Area (WPA). As of January 1989, this was approximately 5055 unleased blocks comprising about 27.8 million acres. This area is lo-

cated from 9 to 222 miles offshore in water depths ranging from 8 to over 3000 m. Excluded from this proposed action are Blocks A-375 (East Flower Garden Bank) and A-398 (West Flower Garden Bank) in High Island Area, East Addition, South Extension, which were deferred because of the environmentally sensitive nature of the biological communities located in the blocks. Alternatives to the proposed action and proposed mitigating measures are available for adoption as described below. The proposed sale areas and the deferred blocks are depicted. Sale areas and lease status are shown in detail.

19225 **(WU/RI—8503) A preliminary geological/engineering evaluation of southwestern Ontarion middle Silurian carbonate reservoirs for enhanced oil recovery.** Macqueen, R.W.; Stock, N.; Chatzis, N.; Dusseault, M.B. (Waterloo Univ., Ontario (Canada). Research Inst.). 1985. 121p. (CE—02317). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report opens with a brief section on the regional setting of Ontario's Silurian oil reservoirs, followed by some background information stating the reasons for studying these reservoirs and the approach taken in studying them. Geological and engineering properties of the reservoirs are discussed, and the potential for enhanced oil recovery from the reservoirs is considered. A detailed description is provided of the laboratory tests performed on selected core samples from the Fletcher reservoir to measure their porosity and permeability. The final section is a description of nine Silurian reservoirs which were selected as having potential for enhanced oil recovery. Overall conclusions of the report include the following. Middle Silurian carbonate reservoirs of southwestern Ontario contain about 70 million bbl of oil; recoverable estimates vary widely, depending on assumptions made, ranging from <1 million to ea 12 million bbl. Silurian reservoirs occur at shallow depths (300-500 m) and are located close to refineries and markets. Thus some of these reservoirs should be primary candidates for enhanced oil recovery schemes. At present, the carbonate blanket facies reservoirs (non-reef), which appear to offer the most potential for early enhanced recovery projects. Of the range of enhanced recovery techniques available, waterflooding and steamflooding with or without chemical additives appear to be the most suitable methods. 20 refs., 47 figs., 9 tabs.

19226 **Vertical-interference pressure testing across a low-permeability zone with unsteady crossflow.** Wijesinghe, A.M.; Kececioglu, I. (Lawrence Livermore Natl. Lab., Livermore, CA (US); Dept. of Mechanical Engineering at the Univ. of Illinois, Chicago, IL (US)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 4, 751-760(Dec 1988).

Existing analytical models for interpreting vertical-interference pressure tests across the low-permeability zone in a three-layered reservoir usually assume transient radial flow in the high-permeability layers and pseudosteady vertical crossflow in the intervening tight zone. The neglect of vertical flow in the high permeability layers and of radial flow in the tight layer requires that the permeability contrast between these layers be large. When this assumption is satisfied, however, it is also very likely that the pressure diffusivity in the tight layer is much smaller than that in the high-permeability layers. Thus, to be consistent, the flow across the tight layer must be treated as an unsteady diffusive process driven by the transient pressure changes occurring in the high-permeability layers. In this paper, the authors extend the analysis of Ehlig-Economides and Ayoub by replacing their pseudosteady crossflow assumption with unsteady crossflow and interpret the crossflow response in terms of near- and far-boundary flow-response functions for the tight zone. Exact and asymptotic solutions and type curves for the wellbore pressures at the upper and lower perforations are presented for flow-rate-specified vertical interference tests. The solutions account for different formation properties, wellbore storage, and skin factors of the two high-permeability layers and the formation properties of the tight zone. The impact of unsteady and pseudosteady crossflow model assumptions on the wellbore pressures and on the spatial distributions of fluid pressures and crossflow rates is examined in detail.

19227 **Advances in borehole seismic fracture diagnostics.** Thorne, B.J.; Morris, H.E. (Sandia Natl. Labs., Albuquerque, NM (US)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 4, 711-715(Dec 1988).

Recent redesign of the hardware, software and data-reduction techniques associated with a triaxial borehole seismic system (BSS) have made possible better estimates of hydraulic fracture geometry. The redesigned triaxial system now incorporates three geophones per axis and proves 30 times the downhole gain of the replaced system, resulting in improved signal-to-noise ratios. This stronger signal, with an increased digitization rate for each of the six simultaneously digitized channels from two borehole seismic tools, has made possible the acquisition and processing of data that previously were inaccessible. The new electronics makes use of a null system and an improved calibration system that includes a synthetic event generator to produce sinusoidal signals of specified amplitude, frequency, and phase. These make readjustments to maintain system balance while the tool is in place downhole. A maximum likelihood event location scheme, incorporating an algorithm based on the use of directional statistics, is used to compute the location of microseisms and error estimates for these locations. Based on the ability to locate perforation shots, a 25-ft [7.6-m] uncertainty in the location of individual microseisms is the estimated accuracy of the redesigned system. This resulted in a fairly high level of confidence in the determination of the azimuth of the Nov. 1, 1986, hydraulic fracture in the fluvial zone at DOE's Multiwell Experiment (MWX) site.

19228 **Patterns of permeability in eolian deposits.** Goggin, D.J.; Chandler, M.A.; Kocurek, G.; Lake, L.W. (Univ. of Texas (US)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 2, 297-306(Jun 1988).

The eolian, Jurassic Page sandstone of northeastern Arizona is marked by a highly ordered heterogeneity. The heterogeneity is expressed by the intricate association of stratification types, which are a direct result of the depositional processes. The dominant stratification types in eolian reservoirs are grainflow, grainfall, and wind-ripple deposits, which form on the lee faces of migrating dunes; interdune deposits, which form between migrating dunes; and extra-erg deposits, which occur sporadically when other depositional environments encroach upon an eolian system. These stratification types each have a unique permeability range, which implies that the fluid migration routes in eolian reservoirs will be dictated by the geometry and types of stratification present. One of the most important aspects of this study is the correlation of qualitative geologic descriptions with quantitative variables such as permeability. About 2,000 measurements were made with a field minipermeameter on an outcrop of the Page sandstone. These data show that three distinct permeability modes directly relate to the different stratification types.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 19266, 20342

19229 **(DOE/BC/10508—38) Bacteria transport through porous material: Final technical report.** Yen, T.F. (University of Southern California, Los Angeles (USA). Dept. of Civil Engineering). 13 Feb 1989. Contract AS19-81BC10508. 96p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007812/JAW.

The injection and penetration of bacteria into a reservoir is the most problematic and crucial of the steps in microbial enhanced recovery (MEOR). In the last phase of our work valuable information on bacterial transport in porous media was obtained. A great deal of progress was made to determine chemical bonding characteristics between adsorbed bacteria and the rock surfaces. In order to further enhance our knowledge of the effects of surface tensions on bacteria transport through porous media, a new approach was taken to illustrate the effect of liquid surface tension on bacterial transport through a sandpack column. Work in surface charge characterization of reservoir rock as a composite oxide system was also accomplished. In the last section of this report a mathematical model to simulate the simultaneous diffusion and growth of bacteria cells in a nutrient-enriched porous media is proposed.

19230 (DOE/BC/10843—14) Investigation of the application of gelled polymer systems for permeability modification in petroleum reservoirs: Quarterly report, July--September 1988. Willhite, G.P.; Green, D.W.; Thiele, J.L.; Mertes, K.B. (Kansas Univ., Lawrence (USA). Dept. of Chemical and Petroleum Engineering). 1988. Contract AC19-85BC10843. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008866/JAW.

The objectives of this report are to improve performance and predictability of in situ gelation processes designed to increase volumetric sweep efficiency of fluid displacement processes. This report discusses the kinetics of gelation and the reduction of Cr(VI) to Cr(III) by thiourea; in situ gelation of polyacrylamide/Cr(III) system; in situ gelation of a xanthan/Cr(III) system; and correlations and mathematical modeling of in situ gelation. 4 refs., 3 figs. (CBS)

19231 (DOE/BC/14286—1) Proceedings of the improved oil recovery conference. King, J.W. (Hardin-Simmons Univ., Abilene, TX (USA). Fairleigh Dickinson Research Center). Mar 1989. Contract FG22-88BC14286. 341p. (CONF-8809301—). NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000732/JAW.

From Improved oil recovery conference; Abilene, TX, USA (11 Sep 1988).

The goal of this conference was to introduce enhanced oil recovery (EOR) and other improved oil recovery (IOR) techniques to the many independent oil operators in this area. Topics of discussion included surfactant/polymer recovery, CO_2 injection, polymer augmented waterflooding, hydrocarbon leaching, control of water production, improvements in gelled acid technology, and new variations in chemical EOR. Individual projects are processed separately for the data bases. (CBS)

19232 (NIPER—372) New techniques of pore-scale visualization of fluids in porous media:The effect of pore structure on fluid distribution: Topical report. Mahmood, S.M.; Maerefat, N.L. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Mar 1989. Contract FC22-83FE60149. 45p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000731/JAW.

This report describes the results of a study initiated to determine the effects of variations in pore structure on fluid distribution in reservoir rocks. It presents a state-of-the-art review and evaluation of the existing micromodel fabrication technology. It also describes the technical and operational details of three new techniques developed in this project, viz grain-cast, rock-slab and freeze-cut-and-encapsulate models. Isolated displacement experiments were performed in the rock-slab micromodel and videomicrographs were taken. Several photographs are presented showing fluid distribution at different conditions. These novel techniques provide a new insight into fluid movement/distribution in real reservoir rocks. Controlled displacement studies are planned in Phase II of this project using these three novel techniques. 60 refs., 16 figs., 2 tabs.

19233 (PRI—RR-42) Adsorption of pure surfactant and petroleum sulfonate at the solid-liquid interface. Novosad, J.; Baxter, L.A. (Petroleum Recovery Inst., Calgary, Alberta (Canada)). 1979. 29p. (CE—02242). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report is concerned with the retention of surfactants considered for tertiary oil recovery in reservoir rocks. A fundamental analysis of experimental variables is included which shows that a maximum in the surfactant adsorption isotherm should be expected. Advantages and disadvantages of using experimental variables such as surface excess, amount adsorbed and selectivity are discussed and the relationships among these are developed. For example, it is shown that selectivity is the most suitable variable for extrapolation of experimental data. In a discussion of the adsorption of surfactant mixtures, difficulties in analyzing experimental data are pointed out and a method for determining adsorption of surfactant mixtures from the data on adsorption of individual surfactants is suggested. Calculations showing that the overall isotherm may be quite different from the isotherms of individual surfactants are performed. Experiments concerned with solubilities of surfactants in brines in a presence of alcohol cosurfactants indicate that quite large amounts of alcohol are needed to keep surfactants fully dissolved in brine solutions. Experimental results are presented on adsorption of pure surfactant and petroleum solfonates on Berea sandstone. These indicate that retention of surfactants is related to their solubility limits in the brine. 15 refs., 15 figs.

19234 (SAND—88-1056C) Reservoir parameters affecting electrical geodiagnostic evaluation of steamflood performance. Mansure, A.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 39p. (CONF-8807158—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008046/JAW.

From SEG workshop on reservoir geophysics; Dallas, TX, USA (31 Jul 1988).

As part of the development of electrical geodiagnostic techniques for mapping enhanced oil recovery processes, two studies on the application of such techniques to steamflooding are reported. First, the extent and growth of a steamflood pilot was studied as the basis for setting goals on the geometric resolution desired of steamflood mapping. This work includes guidance for both vertical and areal resolution of the steam zone. Second, the theory of electrical resistivity of a steamflood is reviewed and used to evaluate the resistivity changes expected. A conceptual electrical model of a steamflooded porous reservoir is presented. This conceptual model is based on a qualitative description of the fluid zones of an ideal heavy oil steamflood. The model assumes that salinity, temperature, and saturation are the important factors controlling the resistivity changes and that Archie's law applies. It was found that the characteristics of each individual reservoir must be considered before the in situ resistivity changes are predicted and that the in situ resistivity can increase or decrease as a result of a steamflooding. 29 refs., 4 figs., 2 tabs.

19235 Interference testing. Grader, A.S.; Horne, R.N. (Pennsylvania State Univ. (US)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 2, 420-428(Jun 1988).

A practical consideration of the effects of a single, circular, heterogeneous reservoir subregion on interference transient pressure testing is presented. The production well and the observation wells are external to the circular subregion. The internal circular boundary is considered as a constant-pressure source or as an impermeable subregion. The constant-pressure subregion has significant effects on interference pressure responses regardless of the size of the subregion. Ignoring the presence of a neighboring compressible portion of the reservoir, such as a gas or a steam cap, may yield erroneously high storativities and transmissivities. Multiple interference tests may suggest the probable location of the gas cap. The effects of an impermeable subregion are subtle, and in some cases, large, impermeable portions of the reservoir may not be detected by neighboring interference wells. Some interference tests in the presence of an impermeable subregion may yield high values of reservoir storativities, stemming from a pressure response similar in shape to the line-source response. A map of the positions of interference wells that do not permit the detection of an impermeable subregion is presented.

19236 Altered-stress fracturing. Warpinski, N.R.; Branagan, P.T. (Sandia National Labs. (US); CER Corp. (US)). pp v of Proceedings of the SPE international meeting on petroleum engineering. Richardson, TX; Society of Petroleum Engineers (1988). (CONF-8811135—).

From Society of Petroleum Engineers international meeting on petroleum engineering; Tianjin, China (1 Nov 1988).

Technical Paper SPE-17533.

Altered-stress fracturing is a concept whereby a hydraulic feature in one well is reoriented by another hydraulic fracture in a nearby location. The application is in tight, naturally fractured, anisotropic reservoirs in which conventional hydraulic fractures parallel the highly permeable natural fractures and little production enhancement is achieved by conventional hydraulic fracturing. Altered-stress fracturing can modify the stress field so that hydraulic fractures propagate across the permeable natural fractures. A field test was conducted in which stress changes of 250-300 psi (1.7-2.1

MPa) were measured in an offset well 120 ft (37 m) away during realtively small minifracs in a production well. These results show that stress-altered fracturing is possible at this site and others. Analytic and finite element calculations quantify the effects of layers, stresses, and crack size. Reservoir calculations show significant enhancement compared to conventional treatments.

19237 **An assessment of borehole seismic fracture diagnostics.** Thorne, B.J.; Morris, H.E. (Sandia National Labs. (US)). pp v of Proceedings of the 1988 SPE 63rd annual technical conference and exhibition. Richardson, TX; Society of Petroleum Engineers (1988). (CONF-881012—).

From 63. Society of Petroleum Engineers (SPE) annual technical conference and exhibition: reservoir engineering; Houston, TX, USA (2 Oct 1988).

A five year effort to apply triaxial borehole seismometer technology by detecting microseismic events associated with the fracturing process has been completed. During this time, a number of evolutionary improvements to the borehole receiver have lead to a unique sensor array geometry consisting of four geophone axes, positioned so that each axis makes the same angle with both the horizontal plane and the plane of the clamp arm. This geometry is designed to allow the use of identical geophones on all axes in order to avoid differences in resonance properties of horizontal and vertical geophones, and to distribute any effects of clamp are resonance uniformly to all axes. Each axis consists of four geophones wired in series to provide four times the sensitivity of a single geophone.

19238 **Inducing multiple hydraulic fractures from a horizontal wellbore.** Overbey, W.K. Jr.; Yost, A.B. III; Wilkins, D.A. (BDM Engineering Services Corp. (US); US DOE (US); Grace, Shurse, Moore and Assocs. (US)). pp v of Proceedings of the 1988 SPE 63rd annual technical conference and exhibition. Richardson, TX; Society of Petroleum Engineers (1988). (CONF-881012—).

From 63. Society of Petroleum Engineers (SPE) annual technical conference and exhibition: reservoir engineering; Houston, TX, USA (2 Oct 1988).

A series of stimulations were designed to open and propagate natural fractures known to exist along a 200 foot horizontal well in Wayne County, West Virginia. The stimulations were also designed to induce fractures in the formation as well as propagate the natural fractures by manipulating pressure and injection rates. A number of radioactive tracers were used to determine where fractures were opened and propagated at different injection rates. The tracers were found in fractures in zones other than the one pumped into, a fact considered prima facie evidence that natural fractures with two or more orientations had been opened and propagated. Pressure testing and gas sampling of the isolated zones confirm that fracture communication was accomplished alone nearly 1000 feet of borehole by stimulation of one 400 foot long section. A technique for inducing multiple hydraulic fractures with multiple orientations was demonstrated.

0204 Processing

REFER ALSO TO CITATION(S) 19181, 19184, 19264

19239 **(FRNC-TH—3408) Fabrication and characterization of catalysts for cracking heavy petroleum fractions.** Higel-Muller, A. (Strasbourg-1 Univ., 67 (France)). Sep 1986. 114p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756983/JAW.

The catalyst is made of zeolite only which is not the case in industry where zeolite is diluted in an amorphous matrix. In this way deactivation is delayed by diluting metallic poisoning. However activity enhancement would produce an excess of coke and light gases, then various treatments are required to optimize gasoline production. Deactivation is obtained by acid treatment in an autoclave or by vapor phase treatment with steam on zeolite where ions are exchanged. Accessibility to hydrocarbons is improved by preparation of an open structure for each zeolite particle and thermal stability is improved by increasing the ratio Si/Al.

19240 **(MISA—8807) Cost estimates and implications of the Effluent Monitoring - General and Effluent Monitoring - Petroleum Refining report regulations for Ontario's petroleum refineries.** (MISA Priority Pollutants Task Force). 1988. 43p. (MICROLOG—88-05385). Ontario Ministry of the Environment, Communications Branch, 135 St. Clair Ave. West, 6th Floor, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Estimates of the incremental capital and operating costs to Ontario's refineries of implementing monitoring regulations under the Municipal-Industrial Strategy for Abatement (MISA) program are derived and summarized. Six key monitoring activities or functions were identified: sampling, flow measurement, characterization analyses, routine analyses, toxicity testing and reporting and administration. The total capital cost of complying with the monitoring regulation ranges from $1 million to $2 million with a point estimate of $1.6 million. Of this amount, $208,700 is designated for automated flow measurement and sampling facilities on intake water points. Automated sampling and flow measurement equipment are being installed on virtually all wastewater sampling points in order to avoid recurring labor costs that would be associated with other methods of obtaining these measurements. Total operating costs for 12 months over the 18-month period of the regulations are estimated at $2-2.3 Million. About $145,000 would be spent to carry out characterization, routine and toxicity testing on intake water. An analysis of selected financial impacts was performed on the consolidated financial performance of the petroleum products segment of each oil company except Petrosar. The oil industry views the extra costs of the regulations as necessary cost of doing business. The extra capital costs amount to between 0.6% and 1.86% of the lowest annual capital expenditure reported by each firm since 1981. The extra operating costs amount to between 0.4% and 1.4% of the lowest annual after-tax profits experienced by 4 of the companies between 1981 and 1985. 12 refs., 11 figs.

0205 Products And By-products

REFER ALSO TO CITATION(S) 19298, 20238

19241 **(PB—89-855266/XAB) Effluent treatment in the textile industry: excluding dyes. January 1983-January 1989 (Citations from World Textile Abstracts). Report for January 1983-January 1989.** (National Technical Information Service, Springfield, VA (USA)). Feb 1989. 110p. NTIS PC N01/MF N01.

Supersedes PB—87-864252.

This bibliography contains citations concerning the treatment and reuse of textile-industry effluents. Effluents that contain dyes are discussed in a separate bibliography. Recovery of lubricants, lye, sizing agents, polyvinyl alcohol, zinc, dirt, and heat from textile effluents are discussed. Air and water pollution control technology that is effective in treating textile effluents is discussed. Effluents from synthetic-fiber manufacture and wool-scouring processes are emphasized. (This updated bibliography contains 300 citations, 84 of which are new entries to the previous edition.)

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 19254, 19269, 19668, 19681

19242 **(AMPC—1987) Alberta Petroleum Marketing Commission annual report, 1987.** (Alberta Petroleum Marketing Commission, Calgary (Canada)). 1987. 34p. (MICROLOG—88-06207). Alberta Petroleum Marketing Commission, 1900-250 6th Ave. S.W., Calgary, AB, Canada T2P 3H7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Alberta Petroleum Marketing Commission has the responsibility of selling the Crown's royalty share of Alberta's crude and synthetic oil production; similar services are provided for natural gas including price regulation duties and incentive plans. The

Commission also markets crude oil on behalf of over 200 producers to North American and offshore consumers. The Commission's position as the largest crude oil marketer in Canada enables it to provide analyses of industry pricing and marketing trends to the Alberta government. In 1987, the Commission experienced its first full year of operations under new responsibilities resulting from the deregulation of natural gas prices. These new duties include the determination of the components of natural gas prices; issuance of findings of producer support for netback pricing arrangements; and collection and analysis of information on Alberta natural gas prices and markets. This report summarizes the year's activties of the Commission and includes financial statements.

19243 (CONF-8711230—, pp 33-47) **Limitations of fuel composition from the viewpoint of the refiners.** Schenz, R.; Fritsch, W. (Oesterreichische Mineraloelverwaltung A.G., Vienna). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

Fuels are specified according to the performance criteria required. The refinery operator tries to achieve the best possible application properties using the refinery technology available and taking the safety of the environment into consideration in an economically efficient manner. These efforts are influenced both by the refinery configuration and the range of crude oils, which may vary in quality and quantity, apart from the relevant market structure for fuel oil products. In an overview of these factors, the composition of various crude oils and the primary fractions obtainable by atmospheric distillation, the proportion of residues and the influence of market structures (proportion of petrol, mean distillates, fuel oil) are dealt with. The author continues with a report on the refinery configuration with particular remarks about the composition and manufacture of diesel and carburator fuels (octane level, lead content, volatility criteria). (HWJ).

19244 (DOE/EIA—0109(88/12)) **Petroleum supply monthly, December 1988.** (Office of Oil and Gas, Washington, DC (USA)). 2 Mar 1989. 117p. NTIS, PC A06/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89008191/JAW.

Total US demand for petroleum products averaged 17.2 million barrels per day in 1988, based upon preliminary data received by the Energy Information Administration (EIA) (Table FE1). (Demand is measured as "Product Supplied"), the term is used interchangeably with the term "consumption" throughout the report. This was 505,000 barrels per day (3.0 percent) above the 1987 level and was the highest level of consumption since 1979. A combination of low world oil prices, continued economic growth, and adverse weather contributed to this year's growth in petroleum demand. Other major highlights for 1988 were as follows: (1) motor gasoline demand increased for the sixth consecutive year to 7.3 million barrels per day in 1988, (2) increased demand and declining crude oil production caused net imports (imports minus exports) of crude oil and petroleum products to reach an 8-year high of 6.4 million barrels per day during 1988, (3) extreme weather conditions over much of the Nation during 1988 were a key factor affecting the supply, demand, and distribution of crude oil and petroleum products, (4) inventories of crude oil and petroleum products at the end of 1988 were relatively unchanged from the 1987 level of 1.6 billion barrels, and (5) continued high production by the Organization of Petroleum Exporting Countries caused a general weakening of world crude oil prices during most of 1988. 12 figs., 34 tabs.

19245 (SEG—8811, pp 15) **Crude oil world prices.** Netschert, B. (National Economic Research Associates, Washington, DC, USA). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

The future direction of world oil prices is discussed, with reference to the role of the OPEC nations. OPEC's ability to maintain oil prices by restricting production has been suffering, due to a lack of willingness of certain OPEC members to observe output quotas. This unwillingness to follow its own rules has hindered OPEC's goal of cooperating with non-OPEC nations to restrict production against their own self-interest. Three possible future scenarios are discussed: a continuation of price fluctuations between $10 and $15/bbl, a market collapse and the effective end of OPEC as a cartel, or a restoration of sufficient discipline to establish and hold a price floor of $15-18/bbl. The most likely possibilities are seen as a restoration of OPEC cooperation and setting of a new, lower price of $15 or $16/bbl, and a repetition of this year's market variability (with oil in the $10-15/bbl range for most of the time). Cooperation among OPEC members on establishment of quotas is seen as unlikely, even as demand for oil grows. The quota problem is further exacerbated by the fact that condensate, natural gas liquids, and heavy oils are exempt from quotas. Gas liquids can displace crude as a refinery feedstock, and it is possible that very light crude is being classified as condensate by some countries. Venezuela is developing a heavy oil emulsion that can be burned in existing oil-fired boilers, at a cost as cheap as coal (on a Btu basis); a large market is possible for such a product in thermal power plants. Another complication is the increased ability of some OPEC countries to tolerate low oil prices. A long-term price forecast of $20/bbl by the year 2000 is proposed.

19246 (SEG—8811, pp 41) **Crude oil, Canadian markets. The economics of oil in Canada.** Marriott, W.D. (Independent Petroleum Association of Canada, Calgary, Alta.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

This paper reviews a number of Canadian upstream petroleum and natural gas industry statistics (including oil sand activities) to determine if any conclusions can be reached regarding the financial responses of the industry to changes in prices. Some observations include the following. Real price increases which took place 1976-1984 were wiped out by out by decreases in the past 4 years. Two years receive special mention: 1980, the year of the largest increase, and 1986, the year of the biggest decrease. Profits rose with rising prices in the late 70s but then fell dramatically in 1981. During the falling-price period, unit profits actually rose in 2 of the 4 years (but were virtually eliminated in 1986). Examining the year-to-year percentage change verifies that there is little relation between the prices the industry receives and the profits it realizes. A look at royalties shows that during the rising-price period, provincial royalty growth did not keep pace with price growth, and during the falling-price period, the rate of decrease in royalties was greater than the rate of decrease in prices. With regard to cash flow, the ratio of operating costs to prices remained virtually constant during the rising-price period. Interest expense and taxes are suggested as the reasons for the decrease in profitability in the early 80s. As for industry's reaction to its fiscal environment, the year of highest profit also was the year of highest investment; a high investment in the 1986 disaster year and low investment in the 1987 recovery year are due to time lags in the industry's investment decision making process. 9 refs., 26 figs.

19247 (SEG—8811, pp 36) **Crude oil, Canadian markets. Major new projects, developments.** Nielsen, A.R. (Mobile Oil Canada, Calgary, Alta.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

In 1988 four energy-related megaprojects were launched in Canada, all sharing the common theme of large investments and costs, as well as government-industry joint development. Three of these projects, the OSLO oil sands plant in Alberta, the Husky heavy oil upgrader in Saskatchewan, and the Hibernia oil field on the Grand Banks, will add 110,000 bbl/d of conventional crude and 123,000 bbl/d of synthetic crude to Canada's oil production capacity. The fourth project, the Vancouver Island gas pipeline, is intended to open up a new market for natural gas, lower total oil consumption, and provide energy supply security to southwestern British Columbia. The megaprojects are also expected to stimulate regional economic development, and represent a total pre-production investment of $11 billion. Risks involved in these developments lie with the future price of oil and gas, and with uncertainties in

technology development. These projects are described individually, with an outline of their technical aspects, costs, and financing by industry and government. The future for such megaprojects is also outlined. If a reference price of US$27/bbl for oil by the year 2000 is accurate, there are several candidates for development. These are located in the Beaufort Sea/Mackenzie Delta, Grand Banks, Scotian Shelf, and northern Alberta areas. The USA-Canada free trade agreement is seen as essential for Canada to develop its energy potential. 9 figs., 7 tabs.

19248 (SEG—8811, pp 22) **Inter-fuel competition in central Canada refined products.** Garcin, G.T. (Ultramar Canada Marketing, Montreal, Que.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

An overview is given of the trends in oil and refined product prices in Canada, from the 1960s to the present. The Canadian industry was in a healthy, competitive situation, then the OPEC oil crisis brought about a large increase in oil prices that caused a drop in demand and use of alternate energy sources. The laws of supply and demand eventually prevailed, and oil prices came down; however, during the course of these events, heating oil demand dropped and several refineries closed. Taxes on petroleum products have maintained their price at artificially high rates, thus affecting oil's ability to compete with electricity and natural gas. Recent market trends, on the other hand, show that in certain areas of the country (notably Quebec and the Atlantic provinces) oil for heating and industrial use is very competitive. A key item of interest for the Canadian industry is the export opportunities offered by the free trade agreement with the USA, and new refinery capacity is being installed in locations strategically placed to supply that market.

19249 (SEG—8811, pp 36) **Refined fuels. Analyst's perspective.** Hervieu, P. (Nesbitt Thomson Deacon, Inc., Montreal, Que.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

This paper examines the state of the refined fuel market in Canada and attempts to show future trends in the refining industry. Markets for specific petroleum products are reviewed and reasons are suggested for changes in prices. For gasoline, sales have increased only slightly over the past few years, while the price has decreased by 12%. One reason for this is that the gasoline market has been taken away to some extent by diesel fuel. Aviation fuel's place in the market has not declined as much as for other products, and with the foreseen boom in the airline business, the market for this fuel will grow and become an increasingly significant part of the refinery business. An end of the sales decline for heating oil is suggested, because homeowners have little incentive, given current prices for alternate fuels, to convert to those fuels or to electricity. Motor gasoline supply is forecast to stay tight in the USA, enabling Canada to export its excess. The overall trend seems to be toward higher refined-fuel consumption in the future, a short-term weakness in crude oil prices, with recovery in the mid-1990s when demand will be at a higher level and supply will have weakened. A better rate of return in the early 1990s is foreseen to bring about additions to refinery capacity. 21 figs.

19250 (SEG—8811, pp 29) **Refined fuels. Major refiner's perspective.** Shannon, F.W.D. (Shell Canada Ltd., Calgary, Alta.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

An overview is presented of the Canadian petroleum refining industry, the impact on costs of some recent trends, and the market for refined fuels. Fuel demand and supply are discussed in relation to two scenarios representing the extremes of expanding and stagnating trade. Examination of the flow of light petroleum products in Canada shows that Canada is part of a free international market, and that there is an excess in Canadian refining capacity that is expected to continue in the long term. This particular situation is being aggravated by surplus capacity in other countries, notably by OPEC's trend toward purchasing refining and marketing capacity outside their borders. Another influence on refiners is related to environmental regulation; this involves such issues as the phasing out of lead in gasoline, the requirement to eliminate leaks in underground storage tanks, minimizing pollution from refineries, regulating sulfur content of transportation fuels, and standards for gasoline volatility. These issues will all have some impact on refiners' ability to finance environmental control measures and maintain profitability. The Canadian refining industry has had a lower rate of return than average for manufacturers, is very capital intensive, subject to intense competition, and has potential for increased overcapacity. Possible effects of the aforementioned trends on motor gasoline prices are suggested. 10 figs., 2 tabs.

0208 Waste Management

REFER ALSO TO CITATION(S) 19302, 19303

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 19224

19251 **(EPS—8612) Seabed obstructions to commercial fisheries in areas of petroleum exploration off eastern Canada.** Barchard, W.W.; Mastandrea, L. (Environment Canada, Ottawa, Ontario. Environmental Protection Service; Sea Raven Resources Ltd., Halifax, Nova Scotia (Canada)). 1986. 113p. (CE—02339). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Petroleum-related activities on the Scotian Shelf and Grand Banks of eastern Canada have raised the concern of potential accumulation of debris and its effects on the fishing industry. Debris includes metal objects such as pipes and chains as well as rock or clay heaps left by anchors. Fishing operations using bottom towed gear are the most susceptible to hinderances resulting from debris. Studies were undertaken to identify and evaluate potential debris originating from petroleum activities in the Hibernia and Venture areas and along their respective supply vessel routes. In the Hibernia Study Region of four completed wells and two active drilling rigs, a side-scan sonar survey program revealed that the seabed was free of detectable debris. If debris was present, it was similar in size to naturally occurring features found in the study region. No comparable study was completed in the Venture area. Six Canadian Fishermen's Charts of the two study areas were produced. The charts covered the region of the Scotian Shelf (Emerald Basin, Sable Island, Canso and Misaine Banks) and Grand Bank (St. John's, Virgin Rocks, Hibernia Area). The charts locate the positions of wrecks, wellheads, abandoned wells, obstructions causing gear damage as identified by experienced commercial skippers and the physiographic features of that given region. The obstruction charting program may significantly reduce the incidence of gear damage and at the same time, minimize the region of avoidance by skippers. 39 refs., 22 figs., 3 tabs.

19252 **(INA—ALUR75-76-81) Biodegradability of northern crude oil.** Cook, F.D; Westlake, D.W.S. (Department of Indian and Northern Affairs, Ottawa, Ontario (Canada)). 1976. 65p. (CE—02333). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Field studies on the microbiological degradation of crude oils encompassed the placing of oil-soaked plots in two areas in the Northwest Territories and Alberta. Replicate plots received amendments of fertilizer, oil-utilizing bacteria, fertilizer plus bacteria or were untreated except for the oil. Changes in microbial numbers and chemical composition of recovered oil were determined periodically. The initial stimulatory effect on bacterial numbers brought about by the addition of fertilizers to oil-soaked plots diminished two years after the application to a point where the differences

were no longer significant. Experiments carried out in the Norman Wells area to determine the effect of the amount of fertilizer applied on oil degradation have yielded inconclusive results. The data suggest that at least 2.7 kg of urea-phosphate fertilizer per kl of oil is required to maintain a reasonable oil degradation rate. Preliminary studies on the use of fertilizer coated with chemicals to increase its hydrophobic character indicate that they could be useful in treating wet-land oil spills. Soils from the McKenzie River drainage basin indicate that bacteria are present which can use oil under mesophilic conditions. However, the ability to use the same oil under psychrophilic conditions is more restricted. At least one bacterial species from each mixed population studied was capable of bringing about chemical changes in oil similar to those observed for the original mixed culture. The potential hazards and uses of the seeding of oil spills is discussed relative to the environmental conditions found in the northern part of Canada. 35 refs., 2 figs., 15 tabs.

19253 (WSL-LR—654-(AP)) Survey of hydrocarbons around petrochemical complexes in Scotland. Final report 1987. Bailey, J.C.; Galbraith, R.; Galbraith, J.; Moncrieff, R.; Stewart, R.; Schmidl, B.; Walker, D.S. (Warren Spring Lab., Stevenage (UK)). May 1988. 79p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Ambient air samples of 24 hours duration have been taken at a fixed point within the Grangemouth complex in a series of 5 day surveys extending from 1982-1986. Simultaneous sampling at 3 sites in Grangemouth has taken place over a shorter period and three crosswind profiling exercises were carried out in this locality. The samples were analysed for C/sub 2/-C/sub 5/ hydrocarbons above 10 vpb and the results are presented and discussed in the light of plant and meteorological conditions. Further 24 hour measurements have been undertaken at three sites near the Braefoot Bay shipment terminal and four sites around the Mossmorran petrochemical complex. The results from surveys before and after start up of activities at these two are presented and discussed.

0210 Legislation And Regulation

19254 (DOE/CH/10381—2) State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 2. Gonzales, H. (National Consumer Law Center, Washington, DC (USA)). Feb 1989. Contract FG02-88CH10381. 70p. The National Consumer Law Center, 236 Massachusetts Avenue, NE, Washington, DC 20002. Order Number TI89008283/JAW.

This report incorporates information collected by National Consumer Law Center in telephone surveys conducted primarily from late January through February, 1989. The information collected on the status and state uses of both Exxon and Stripper Well funds is contained in four sections: Section I provides background information regarding the two main sources of oil overcharge funds distributed to the states since 1986. Section II provides a brief overview of NCLC's findings on the status of state allocation decisions and on specific uses of these funds. Section III of the report gives specific examples of some of the programs or projects funded with the money, with an emphasis on low-income uses. Section IV contains important notes relating to a series of nine tables.

0230 Properties

REFER ALSO TO CITATION(S) 19243, 19252

19255 (CONF-8711230—, pp 1-31) **Fuel requirements from the viewpoint of the engine-makers.** Gruden, D. (Porsche (F.) A.G. Entwicklungszentrum Weissach (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

An overview is given of those properties of vehicle fuels having a direct influence on the dimensioning and characteristic specifications of a combustion engine. These are: octane (normal, knock), calorific value (explanation in formulae), density (fluctuations in petrol fuel can influence engine consumption in the USA by up to 7%), boiling process (boiling curve, evaporation, cold start) and vapour pressure (temperature influence, driving characteristics). The report also goes into the engine combustion products (exhaust) and their harmfulness to the environment (improvement of combustion process), and also into alternative fuels (CO/sub 2/ in concentration, greenhouse effect, hydrogen, alcohols from biomass, methanol). Attractive future fuels could be a combination of hydrogen with conventional fuels and biomass alcohols. (HWJ).

19256 (CONF-8711230—, pp 187-213) **Market research for carburetor fuels.** Schindlbauer, H. (Technische Univ., Vienna (Austria)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

Carburator fuel samples taken at 17 filling stations in Austria produced the results published here (characteristic figures) on analysis. For standard grade and high-octane petrol: density, vapour pressure evaporation residue, lead content, benzole, alcohols, (methane-t-butanol; i-butanol), MTBE, total oxygen content, boiling behaviour, ROZ and MOZ. For diesel fuels, the density, sulphur, CFPP, flash point, boiling behaviour and cetane figures were determined. Comment is made on the individual analysis results. All in all, it was found that the quality was up to standard, with very few exceptions. The cetane values were above standard, whereas the flash point was somewhat or well below in 25% of the samples analysed. (HWJ).

19257 (FRNC-TH—2855) Measurement of vapor pressure of heavy hydrocarbons. Allemand, N. (Lyon-1 Univ., 69 (France)). 1985. 160p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756981/JAW.

A device is developed for low pressure measurements based on inert gas saturation. Reliable results are obtained for alkanes or alkylbenzene from C 10 to C 20 in the range 0.01 to 10 mm Hg and 50 to 250 /sup 0/C. The measure is characterized by gas phase chromatographic analysis of hydrocarbon saturated gas and a sampling loop allowing fixed volume injection of saturated gas in the chromatograph. 40 refs.

19258 (FRNC-TH—3409) Thermal behavior, structural analysis and flocculation of heavy petroleum products. El-Mohamed, S. (Bordeaux-1 Univ., 33 (France)). 1986. 165p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756982/JAW.

Heavy petroleum fractions are characterized by the thermal behavior, in particular by appearance and texture of the mesophase. Magnetic properties of heavy petroleum products are studied. Solutions of heavy petroleum products are examined: structure and viscosity of colloidal solutions, influence of solvent and flocculation when a flocculating agent is added and in particular heavy products aggregation.

03 NATURAL GAS

19259 (CONF-8706376—1) IGT's microcomputer cooperative. Landahl, C.D.; Bukacek, R.F. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 10p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007164/JAW.

From Personal computer applications in the gas industry symposium; St. Charles, IL, USA (22 Jun 1987).

IGT's Member companies can maximize their use of microcomputers by sharing microcomputer experience and exchanging customized, non- licensed software. This interchange is facilitated by the Microcomputer Cooperative operated by IGT as a service to it Members. The experience of operating this system has been applied to extension of the cooperative's services. The features of the system and the method of operation are described. Over 40 companies are currently registered to use the Cooperative and over 20 programs customized to solve gas industry problems have been entered into the database. 2 tabs.

19260 **(STEV—1988-6) Research in natural gas technology.** (Statens Energiverk, Stockholm (Sweden)). 1988. 77p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757075/JAW.

The report presents the proposal of National Energy Administration for natural gas research during the period 1987-1990. A summary of the financing is presented in the following, where the figures show the cost in MSEK for present and planned activities 1987-90. * Distribution and storage, 10; * Combustion technique, 35; * Electricity production, 25; * Heating and gas technical applications in buildings, 10; * Industrial processes, 10; * Natural gas as engine fuel, 5; In total MSEK 95. The public research efforts should primarily be directed towards development of fundamental knowledge and competence and expertise at universities. (O.S.).

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 19224, 19228, 19263

19261 **(DOE/MC/24264—2654) Re-analysis of the MWX [Multi-Well Experiment] fracture stimulation data from the Paludal zone of the Mesaverde formation: Annual report, FY 1988.** Smith, M.B.; Miller, W.K. II. (Nolte-Smith, Inc., Tulsa, OK (USA)). Nov 1988. Contract AC21-87MC24264. 166p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000927/JAW.

For a number of years the US Department of Energy has been engaged in research to enhance gas recovery from "tight gas sands", particularly the lenticular sandstone formations common to the western United States. To investigate these western US tight gas sands, DOE established the Multi-Well Experiment (MWX), a field research facility near Rifle, Colorado, where three closely spaced wells were drilled through the lenticular Mesaverde formation in the Piceance basin. Testing included extensive coring and core analysis, production testing, and instrumented fracture stimulation experiments. Because one of the more important aspects of the MWX project was to establish the predictability of well stimulation procedures, extensive pre-frac testing was conducted in the Paludal, Coastal, and Fluvial zones. This report concentrates on a review and re-analysis of the MWX stimulation data for the Paludal zone. The primary goal of the review was to establish the conditions affecting fracture geometry and behavior in this lenticular environment; and determine the degree of predictability of fracture behavior from pre-frac testing. 13 refs., 44 figs., 9 tabs.

19262 **(SV-UG—1988-25) Mathematical and statistical evaluation of the gas data in context of the geological framework. Swedish deep gas project.** Granath, G. (Swedish State Power Board, Vaellingby). 20 May 1988. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757096/JAW.

This paper is primarily aimed at the results of the various mathematical treatments of gas data from the Gravberg well. The theoretical backgrounds to the mathematical algorithms are, for reasons of brevity, not included here but the interested reader will hopefully find adequate guidance from the references. The results are presented according to media sampled, and characteristic features outlined. Some more general conclusions are sometimes drawn, especially in cases where the underlying features would perhaps escape the attention of geologists without daily confrontation with mathematics. The conclusions, or hypotheses rather, should of course be tested against other findings, as well as experiences gained, from this and other wells. From the horizon of this particular investigation, the results are intriguing as the data seem to fit the known geological features well, and the derived gas-populations are explainable in terms of geology or contaminous phenomenon. A significant part of all types of gas sampled has a high possibility to be of deep-origin, although the final verification remains to be accomplished until the drilling is brought to its target depth.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 19235, 19286, 19287, 19289

19263 **(DOE/FE/60600—T21) Dry gas zone, Elk Hills Field, Kern County, California: General reservoir study: Engineering data, effective August 1, 1988.** (Evans, Carey and Crozier, Bakersfield, CA (USA)). 10 Jan 1989. Contract AC01-85FE60600. 362p. NTIS, PC A16/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006487/JAW.

This reservoir study of the dry gas zone of Elk Hills Field is a data compilation with information relating to well: completion; production; pressure; and back pressure. (JF)

19264 **(IVO-A—07/87) Separation of gases with membrane technology.** Sonninen, R. (Imatran Voima Oy, Helsinki (Finland)). Aug 1987. 62p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757044/JAW.

The study presents current applications of gas separation based on membrane technology, the focal points being the basic chemical industry, petrochemical industry and refining of oil and natural gas. The study has also dealt with general principles of gas separation as well as equipment and process solutions applied. Gas separation is advancing faster than any other field of membrane technology. It has gained foothold as an industrial method in quite a short time. At present, membrane separation of hydrogen is already a standard procedure and the method has also been extended to enrichment of nitrogen and oxygen and to removal of carbon dioxide. So far, pilot and labortory tests have been carried out on other membrane applications for gases. The present gas separation equipment can well be used to separate relativey small amounts of gas. In the treatment of large amounts of gas conventional methods, such as the gryogenic method based on liquefaction of gas, are clearly the most economical.

19265 **Instantaneous and efficient surface wave excitation of a low pressure gas or gases.** Levy, D.J.; Berman, S.M. (to Dept. of Energy, Washington, DC). US Patent 4,792,725. 20 Dec 1988. Filed date 10 Dec 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a fluorescent lamp illumination system for substantially instantaneously providing partial ionization of a low pressure fill of gas or mixture of gases in a tube and subsequent continuous excitation of the low pressure gas or gases in a surface wave mode for emitting light along the length of the tube, comprising: a source of rf energy; a fill of a permanent, particular volume of low pressure inert gas or gases and mercury vapor; an elongated cylindrical tubular discharge container for confining the fill therein and having first and second closed ends and a cylindrical wall that is optically transparent to visible radiation, the wall having an inner surface and an outer surface, the container being permanently sealed to contain the fill, the inner surface of the discharge container being coated with phosphor the fill being in direct contact with the phosphor; coupling means having a predetermined impedance and responsive to rf energy from the rf source to couple the energy to the fill to both ionize at least a portion of the fill to create a weakly ionized plasma and to deliver the rf energy in a surface wave mode to energize the fill to sustain the plasma, a majority of the energy being delivered through the wall to an area near the inner surface to thereby instantaneously ionize and substantially continuously excite the fill so that the majority of mercury atoms of the mercury vapor near the inner surface produce u.v. photons that interact with the phosphor to produce visible light.

19266 **Downhole pneumatic turbine motor.** Lyons, W.C.; Miska, S.Z.; Johnson, P.W. (New Mexico Inst. of Mining and Technology, NM (US)). pp v of Proceedings of the 1988 SPE 63rd annual technical conference and exhibition. Richardson, TX; Society of Petroleum Engineers (1988). (CONF-881012—).

From 63. Society of Petroleum Engineers (SPE) annual technical conference and exhibition: reservoir engineering; Houston, TX, USA (2 Oct 1988).

A new motor has been developed for use in air/gas drilling operations. Numerical simulation indicated that such a motor was feasible, and a prototype has been built. The prototype has undergone extensive bench testing and two successful field tests. The downhole pneumatic turbine drilling motor is expected to prove useful in making course corrections and in infill drilling for enhanced recovery.

0304 Products And By-products

19267 **(CONF-8805266—1) Developments in non-utility uses of liquefied natural gas (LNG).** Anderson, P.J. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 17p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007173/JAW.

From Distribution/transmission conference of the American Gas Association; Toronto, Canada (16 May 1988).

The development uses, and market for liquefied natural gas (LNG) is addressed. Applications discussed include aircraft fuel, rocket fuel, diesel locomotive fuel, and as a refrigeration source for a shrimp boat in a demonstration program. 3 figs. (CBS)

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 19242, 19290, 19291, 19668, 19681, 19710, 19810, 19830

19268 (CGA—1988, pp 9) **Gaz Metropolitain's Technology Transfer program.** Gauthier, P.L. (Gas Metropolitain, Inc.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

The author distinguishes between technological development and demonstration, and defines technology transfer as the transmission of knowledge with or without the concurrent transfer of goods and services to our customers or end-users. Gaz Metropolitain has chosen the technology transfer route for the following reasons: available resources, time factor (one half the R&D time), and worldwide availability and access to R&D in gas technology (non-competitive). The methodologies that facilitate the technology transfer route are exchanges and agreements with gas utilities that have devoloped successful new technology, selecting sites within the territory served by Gaz Metropolitain for demonstration projects, providing financial and technical support for demonstration projects, publishing results and introducing new products, joint commercial ventures with manufacturers, and taking part in related conferences and trade fairs. Communication, an essential element in the process of technology transfer, is facilitated by technical data sheets to inform customers about advanced gas technology and equipment and by technical newlestters and seminars. The author emphasizes the importance of new gas technologies being produced in Canada or the United States, the infrastructure of sales and service support being present for successful technology transfer, and the pairing of R&D within the company.

19269 (CGA—1988, pp 16) **Marketing: the only constant is change.** McLauchlan, C. (McLauchlan Mohr Massey Ltd.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

In this paper, the author stresses the importance of change within the field of marketing and applies it to the natural gas industry. First discussed are the effects of deregulation, seen as a positive development as long as reasonable price stability can be maintained. Concern for the environment is explained as having both potential problems and opportunities. As a fuel, natural gas is likely for a cleaner environment since it is clean burning and non-polluting. Since the environment is a predominant issue, it presents great opportunities for the gas industry. The consumer marketing end of the industry is examined, with gas fireplaces in particular cited as a good example of new marketing opportunities. The author states that since the natural gas industry is in the business of fulfilling customer needs, leadership in marketing innovation is required to fulfill their needs more effectively.

19270 (CGA—1988, pp 16) **Future North American natural gas marketing innovation.** Cameron, G.W. (Pan-Alberta Gas Ltd., Calgary, Alta.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

This paper reviews the changes that the natural gas industry has undergone in the past few years. Since the late 1970s, the situation has changed from limited proven reserves and deliverability, and a fear of potential supply shortage to one of today's significant surplus situation. One of the prime reasons was that of price. The rising world energy prices of the late 70s saw the wellhead price for natural gas rise dramatically in Canada and the US. It became profitable to explore for and develop natural gas reserves, and therefore deliverability was enhanced. As well expectations of world energy shortages with high energy prices has changed to a situation where these higher price expectations resulted in exploration activity which brought the world markets vast new energy supplies. The result is a substantial surplus of natural gas and increased competition from low cost world crude oil. At the same time, consumers looked to ways of reducing their energy and natural gas needs. As a result, natural gas demand dropped in the US from the 21 TCF range in the late 70s to the 16 TCF range in the mid 80s. Supply shortage became surplus accompanied by a drop in market demand. Government regulatory changes have resulted in open competition, negotiated price, quick short term arrangements, revised exportable surplus, and specific export hearings. Innovations seen by the author as needed within the industry include purchasing gas at the wellhead, fixed prices, rate of take, and marketing methods.

19271 (CGA—1988, pp 9) **Competitive gas markets: Canada leads the way.** Musgrove, M. (Energy, Mines and Resources Canada). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

Canada is cited as the most competitive natural gas market in the world and compares it to those of the United Kingdom, Japan, and the United States. With reference to the 1985 Agreement on Gas Markets and Prices, the major tasks set were: the creation of conditions for a more flexible and market-oriented pricing regime for natural gas, the enhancement of access for Canadian buyers to natural gas supplies and for Canadian producers to natural gas markets, and the fostering of a competitive market for natural gas consistent with the regulated character of the transmission and distribution sectors of the industry. The most obvious effect of government withdrawal has been a decline in prices. In the first year of price deregulation, the weighted average cost of gas sold in the Canadian market declined 32% from $2.79/GJ to $1.91/GJ. A similar pattern has emerged with export prices. Canadian gas prices are in step with the market. Regulatory barriers to export sales have effectively been removed by the introduction of market-based surplus determination procedures, by the removal of volume and end user restricitons on exports by short-term order, and by ongoing efforts to expedite the federal approval process. Regulatory barriers to the interprovincial gas market have also been lessened. Benefits to consumers include the lowest commodity prices for natural gas in real terms since 1976, gas prices that are very competitive with alternate fuels, and greater gas supply choice than ever before. A balanced, co-operative approach among all segments of the industry will be essential to sustain and expand marketing efforts.

19272 (CGA—1988, pp 20) **Step up, speak out and lead.** Martin, R.W. (Consumers' Gas Co. Ltd.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

This paper addresses the redefined role of the gas distribution within a deregulated industry. The distributors' traditional role has begun its evolutionary change, and moved from aggressive marketers to a facilitator of services for consumers. Among new marketing opportunities will be the exploitation of new or underused applications for gas in the home; examples cited have been the gas fireplace, the Smart House, and affordable home ownership. Emphasis should now swing towards a better servicing job, that is, upon educating, guiding, and counselling. The topic of cogeneration and combined cycle generation of electricity is cited as an additional new technique, representing a significant potential to build baseload gas sales. Political support is cited as an important factor. An additional marketing opportunity is the development of natural gas vehicles, particularly in reducing environmentally damaging emissions. The NGV [natural gas vehicle] program can create new job opportunities and a new technical infrastructure. To be successful within this field, the watchwords have become flexibility and a willingness to try new methods.

19273 (CGA—1988, pp 6) **Opening remarks, C.G.A. Marketing Conference.** Burton, M.F. (Marketing Managing Commitee). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

Environmental concern is predicted to be the major issue of the 1990s. Two markets which show promise in positioning natural gas as a clean energy form are in industrial applications and NGV. The Canadian Gas Association is evaluating commercially available industrial gas technology and equipment to transfer new technolgy to the Canadian gas industry. There are many new processes available that can greatly enchance emissions in industry. NGV (natural gas vehicles) now account for more than 18,000 vehicles and 170 fueling stations. Increasing the use of natural gas in truck and bus diesels will increase consumption of natural gas and help justify the number and size of fueling stations, thus accelerating market penetration. Natural gas transit buses have been operating successfully in a number of cities; a five-year demonstration program is in effect. In the residential market, the move towards minimum efficiency standards for gas space and water heating equipment is of concern to the natural gas industry. This opens the door for industry consultations with the federal government to determine whether government proposed actions are constitutional. One of the major issues facing the natural gas industry is the question of core markets and gas security of supply. New technologies must be searched to increase the share of the energy market.

19274 (CGA—1988, pp 9) **Opening remarks, CGA Marketing Conference.** Dafoe, B.M. 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

This paper presents, from the marketer's point of view, the emerging issues that the natural gas industry will face in the future. Of major concern is the increasing worldwide concern with the environment, that is, the ozone layer and greenhouse effects. Combustion of natural gas produces CO/sub 2/, but only one quarter the amount as is produced by the same energy equivalent of other fossil fuels. As confirmed in the Energy Options report, the necessary link between present and future energy economies is technology. It is vital for the natural gas industry to continue to develop more efficient, environmentally sound processes for utilization of gas. It is also essential that funding be available to support research and development of new utilization technology. Transfer of information on new natural gas utilization technolgy to marketing personnel is needed to ensure effective demonstration of R&D. The role of the gas marketer is explained to be that he be in the right place, at the right time, in the right amount now and in the future, and at a competitive price.

19275 **(CGA—1988) Leadership through innovation.** (Canadian Gas Association, Don Mills, Ontario). 1988. vp. (CONF-8810325—; CE—02492). Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN.

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

The topics of discussion covered during the Canadian Gas Association's marketing conference included competitive sales, marketing techniques, innovation and change within the natural gas industry, government regulations, and energy saving technology applications. A total of 14 papers have been abstracted from this conference.

19276 **(ERCB—GB88-12) [ERCB] 1989 provincial program of subsurface pressure surveys and deliverability testing for gas pools.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 158p. (CE—02349). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.

The schedule for Alberta's program of gas pool tests is presented in this bulletin. Information is presented alphabetically according to name of field, then name of pool. For each pool the name of the coordinating operator or operators is provided, along with the time of the pressure survey and deliverability testing as well as any relevant remarks.

19277 (SEG—8811, pp 8) **Inter-fuel competition in central Canada natural gas.** Giles, M.G. (Canadian Gas Association, Don Mills, Ont.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

The marketing of natural gas in Canada is discussed in the context of competition with other energy sources, notably electricity. Historically, gas has had to use innovative marketing in order to be able to compete with other energy sources that had more flexibility in their pricing and other policies (unlike gas, which was more regulated). New developments in fuel-efficient equipment, the freeing of gas prices by deregulation, and the public's perception of natural gas as an inexpensive and efficient energy form have increased the attractiveness of gas in Canada's energy market. Ongoing efforts to hold and increase this market share include research and development in energy-efficient appliances, development of the SMART house concept and R2000 housing, promoting use of natural gas in industrial boilers and combustion systems, using flexible tubing and plug-in outlets for convenient gas distribution within buildings, and research and development of natural gas fuel cells and natural gas-fuelled vehicles.

19278 (SEG—8811, pp 17) **Natural gas liquids. Alberta perspective.** Matieshin, K. (Chevron Canada Resources, Calgary, Alta.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

The major factors affecting the supply of natural gas liquids (NGLs) and their Alberta market are discussed. These factors include the fact that NGLs are produced at gas plants, thus NGL production is directly tied to gas production; the use of ethane in enhanced recovery, and the likely decline of this market as enhanced recovery schemes become uneconomic; Alberta ethane policy; competition from Alaskan sources; and proposed gasoline vapor pressure reductions in the USA which will affect the butane market. The ethane market is expected to be affected not only by the decline in enhanced recovery, but also by the increasing production of gas liquids and their extraction in new field extraction plants. However, new ethylene plants in Alberta will add to ethane demand and overall ethane markets are expected to show growth. Petrochemical market demand for NGLs means that long-range

transportation is very important; currently, this is done through the Interprovincial Pipeline (which mainly handles crude oil and refined products, but can transport NGLs if they are delivered at high rates) and the Cochin Pipeline (which handles specification products such as ethane and propane). A future project, Soligaz, is proposed for the movement of NGLs from Sarnia, Ontario (the current NGL pipeline endpoint) to Montreal. This would open up a significant new market for propane and butane. NGL prices are seen to be affected by oil and gas prices, and by the supply/demand balance; low oil prices and excess of supply are expected to result in tight markets and soft prices in the short term. 9 figs.

19279 (SEG—8811, pp 36) **Natual gas liquids. Central Canada perspective.** Robb, C. (CanStates Energy, Calgary, Alta.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

An overview is presented of the Canadian natural gas liquids (NGL) industry. The most important characteristics of this industry are the following: that NGLs are a by-product of crude or natural gas production, therefore their supply is not controlled; and that NGLs have a high vapor pressure, which creates transport and storage problems. The strategic !se of storage is seen as critical to industry success, as NGLs are produced whether customers want them or not. Underground storage in salt beds has been a major breakthrough in this respect. Transport of NGLs in Canada is via a number of pipelines from Alberta to Ontario or US facilities, coupled with shorter-range transport by railcars or tank trucks. The current market for NGL products is reviewed. Factors relevant to this market include: excess of supply over demand in Canada, and the reverse situation in the USA; competition from offshore sources; and inaccessibility of eastern Canadian markets to most Western producers. Examination of the market for specific NGLs indicates that propane pricing is controlled by the demand from the petrochemical industry; ethane demand in Canada is dominated by petrochemical and miscible-flooding uses; and butane is mainly used for gasoline blending, with future potential in the petrochemical feedstock market. Pentanes plus find a market in the West as a diluent for heavy oil, and in the East as a petrochemical feedstock. A future decline in the miscible flood market will mean an increase in NGL availability, which will require those NGLs to be moved eastward to supply petrochemical markets. 5 figs., 8 tabs.

19280 (SEG—8811, pp 20) **Gas futures, energy futures.** Levin, R. (New York Mercantile Exchange, USA). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

The concept of futures trading in the oil and gas market is outlined as a way to improve business planning. Recent deregulation of the natural gas market has brought about the development of a spot market showing pricing volatility. A natural gas futures market is seen as a natural complement to this development, and the introduction of a natural gas futures contract by the New York Mercantile Exchange has been proposed. The Exchange's previous experience with oil and oil products has been favorable in terms of correlation with actual market prices. The Exchange can also be used as a source of supply and there are several delivery options that can be taken. A number of measures have been taken to ensure contract performance, including capitalization requirements, market trade and financial surveillance, and ensuring liquidity.

19281 (SEG—8811, pp 7) **Natural gas. Domestic gas sales, direct sales.** Minion, W. (Northridge Petroleum Marketing Ltd., Calgary, Alta.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

A small Alberta gas supplier's views are given concerning the marketing of natural gas via direct sales. Certain restrictions currently apply in Alberta which hinder eastern customers and western suppliers from making supply agreements; one is the disallowing of removal permits, which enable export of gas from Alberta, to those wishing to sell gas directly to residential, commercial, or small industrial customers; another restriction is the limitation of removal permits to two years for limited volumes, unless the supplier can prove (possibly requiring a public hearing) that necessary reserves and pipeline capacity are available. Access to transportation is also limited, and controlled in a monopolistic fashion. The ramifications of these policies on the marketplace for natural gas is discussed.

19282 (SEG—8811, pp 20) **Natural gas. Domestic gas sales "system gas".** Hunter, J. (Union Gas Ltd., Chatham, Ont.). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

In a discussion of the Canadian natural gas market from the perspective of an Ontario gas distributor, a number of current myths about the market are outlined and compared to current realities. The idea that distributors cannot control their markets is countered by the reality that western gas suppliers are not making themselves competitive with recent developments in direct purchase, with the feeling that suppliers have to assume more market risk. Concerns that Ontario gas contracts are moving from long term to short term practice are placed in the context of a natural trend that is an outcome of deregulation. Western perceptions about eastern distributors delaying the signing of long term supply agreements due to their waiting for decisions from the Ontario and National Energy Boards are shown to be unrealistic. The perception that distributors only want the lowest possible price is seen to be, more realistically, that they want the lowest practical price that will ensure supply. A recent Ontario Energy Board decision, requiring direct purchasers in the essential service group to obtain 3-year certificates assuring high reliability of supply before transportation service could be provided, is shown to have been grossly misrepresented in the West. Another decision on streaming of gas is shown to be guarding against potential abuses in the supply system, rather than interference in free negotiations. Finally, the idea that eastern distributors are trying to replace long term firm service contracts with spot market gas is shown to be totally unrealistic from the standpoint of deliverability. 1 fig.

19283 (SEG—8811, pp 47) **Natural gas. Exports, a United States perspective.** Stram, B.N. (Enron Corp., Houston, TX, USA). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

A discussion of the near-term outlook for the natural gas market in the USA begins with a prediction of the end of the gas oversupply situation (or gas bubble) in that country. Aspects of the current situation include a gas demand that is unrestrained by pricing, decline in deliverability, and a declining total addition to reserves relative to production. Factors that can affect the market include the seasonal nature of gas demand, with winter demand peaks; the degree of switching by homeowners currently using oil heating; the price of crude oil, which affects the drilling and exploration process for natural gas; and the increasing use of natural gas by electric utilities in combined-cycle generating plants. Canadian opportunities in future American markets are then outlined. These are: system supply for pipelines or distribution networks; spot market sales to industries or utilities; and a special projects market, namely, combined-cycle power plants for the northeastern states. It is calculated that in terms of current economics, such a plant could produce electricity more cheaply, and with lower capital costs and siting times, than coal-fired plants. In the past, developments of gas-fired plants has been hindered by lack of assurance of long term supply; the reserve picture for Canada is felt to be suitable for the provision of long-term supply contracts for such facilities, thus indicating a significant market opportunity. 16 figs.

19284 (SEG—8811, pp 22) **Natural gas. Exports, a Canadian perspective.** Branshaw, M. (Pan Alberta Gas Ltd., Calgary). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

Natural gas exports are discussed from the perspective of one of Canada's largest gas marketers and exporters. An historical overview indicates significant growth in exports to the USA since 1960, and Canadian gas is getting a bigger share of that country's market. Over 90% of these exports leave Canada through four major export points. Prices of this gas are comparable to domestic prices and are competitive in the American market. In a discussion of the future of gas exports, a number of factors are proposed as favoring Canadian gas as continuing to be an integral part of the gas supply situation in the USA. These factors include declining reserves and deliverability in the USA, increased environmental awareness of the desirability of gas as a fuel, pipeline proposals in the USA which include Canadian gas as a supply source, and changing regulations with respect to gas marketing. Constraints to increasing Canadian exports are also outlined, including the size of the Canadian resource base, Canadian domestic demand, export pipeline capacity, and price competition. 5 figs.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 19224, 19287

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 19238

19285 **Geologic and engineering implications of production history from five Mesaverde wells in central Piceance Creek Basin, northwest Colorado.** Chancellor, R.E.; Johnson, R.C. (Rio Blanco Natural Gas Co., Denver, CO (US)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 2, 307-314(Jun 1988).

Five gas wells completed in low-permeability rocks of the Upper Cretaceous Williams Ford and Iles formations in the central part of the Piceance Creek basin, northwest Colorado, have been on continuous production for about 2 years. A general comparison is made between these wells and the Dept. of Energy's Multiwell Experiment (DOE MWX) wells about 30 miles [48 km] to the southeast. The five wells were completed with gelled KCl water/sand fractures in various intervals over a 3,000-ft [910-m] section of largely fluvial and paludal rocks of the Williams Fork and Iles formations of the Mesaverde group. Flow has apparently stabilized at low flowing tubing pressures at a rate of 30 to 125 Mcf/D [0.84 to 3.5 x 10/sup 3/ m/sup 3//d] per well, with minor water and variable condensate volumes. On the basis of production information to date, attempts to select intervals with better-than-average effective permeabilities by state-of-the-art techniques were not successful. The study points out several important differences in the Mesaverde group between the area of the five wells and the MWX site. The differences in the Mesaverde group between the MWX site and the area of the five wells point out the need to expand the MWX data base to include other gas-producing areas in the Piceance Creek basin.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 19276

19286 **(ERCB—8804) Alberta ethane policy. Report on implementation.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 134p. (CE—02357). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.

An ethane policy was developed by the Alberta government in an effort to resolve an ongoing dispute between gas producers and the Alberta Ethane/Ethylene Petrochemical Project. The dispute is centered around the ownership of, or at least the right to extract ethane from, the gas produced in Alberta. The Project obtains its ethane feedstock largely from straddle plants on the main gas pipelines. Until recently, little ethane was extracted from field plants upstream from the straddle plants, but demand for ethane in enhanced recovery has resulted in applications for field extraction of ethane. This would reduce the ethane concentration in the gas going to straddle plants. Hearings were therefore held before the Alberta Energy Resources Conservation Board to resolve issues relating to this competition for ethane between the Project and gas producers. Specific issues considered at the hearing included: determination of which ethane facilities should be affected by, or be a part of, the new ethane policy; principles that should be used in determining threshold volumes of ethane that could be extracted, thereby guaranteeing a certain ethane supply to the Project; procedures that should be used for the expedient regulatory processing of applications for field extraction plants; and the existing and potential efficiency of ethane extraction at the straddle plants, investment required to enhance extraction, and potential linkages with threshold volumes. This report presents the results of the hearings and the recommendations of the Board regarding the issues stated above. 5 figs., 2 tabs.

19287 **(ERCB—D88-16) Shell Canada Ltd., application for a well licence Waterton Field. Decision D88-16.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). [1988]. 41p. (CE—02363). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $5.00 CAN.

An application was made before the Alberta Energy Resources Conservation Board for a license to drill a natural gas well in a sub-alpine basin. This land is classified according to an integrated resource plan such that if the land is used for petroleum development, it would be subject to special conditions and controls to ensure that its recreation intent is preserved and wildland character protected. A hearing was held to consider the views of the applicant and others, including a number of public interest groups concerned with environment and wildlife. The Board considered the following issues at the hearing: the Board's jurisdiction in considering the application; technical matters regarding the need for the well and appropriate well location; gas resource values; wildland/recreational values; ecological concerns regarding biosphere, wildlife, fisheries, vegetation and reclamation; and the need for an ongoing consultative process. Findings of the Board include the following. The well would not pose a serious hazard to the public, and the only technically suitable and safe surface location is that chosen by the applicant. The potential economic benefits of the well would be very large. Near-term economic costs through alteration of wildland recreation values may be significant, but should eventually become imperceptible following land reclamation and revegetation. A program of carefully timed and managed access for construction, drilling, testing, and completion must be put into effect to ensure reliable watershed protection and preserve wildlands; a continuing evaluation and montoring program is also necessary. Accordingly, the application was approved. 3 figs.

19288 **(ERCB—D88-17) Gas removal permit amendment Pan-Alberta Gas Ltd. Decision 88-17.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). [1988]. 24p. (CE—02288). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $5.00 CAN.

Pan-Alberta Gas applied to the Energy Resources Conservation Board of Alberta for permission to amend its permit for removal from Alberta of gas for eventual sale in California. Amendments were requested to extend the term of the existing permit for a further 15 years, adding an incremental volume of gas to be removed, maintaining the annual and daily maximum permitted removal volumes until 1997, and reducing those volumes thereafter. A public hearing was held to consider these matters, and the Board considered the relevant issues to be: total gas reserves available for removal; the established reserves under Pan-Alberta control; access to transportation; the Alberta public interest; and the permit term and maximum permit volumes. The Board found Pan-Alberta's contracted reserves inadequate to support the proposed 25 years of the permit, and that the California market is an attractive and desirable one for Alberta producers, although uncertainties in such areas as

deregulation and free trade make departure from the Board's standard 15-year permit policy undesirable at this time. The Board approved the extension of the removal permit for 6 years and added an incremental volume permitted for removal equal to 15,869 billion m/sup 3/ of gas (ca 42% of what Pan-Alberta requested). The maximum annual and daily volumes permitted were amended according to Pan-Alberta's request. 3 tabs.

19289 (ERCB—D88-23) Universal Exploriations Ltd., gas processing plant, Husar, Wintering Hills, and Seiu Lake Fields. Decision D88-23. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). [1988]. 7p. (CE—02318). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $5.00 CAN.

Czar Resources operates a gas processing plant in Alberta, and processes gas for Universal Explorations on a custom fee basis. Universal applied to the Energy Resources Conservation Board of Alberta for approval to construct and operate a new facility to process the gas it is currently sending to the Czar plant. A hearing was conducted to decide on the approval application, which was opposed by Czar on the grounds that it would unnecessarily duplicate existing facilities. The Board considered the main issues in the hearing to be related to the economic and technical merits of alternative processing arrangements, the right of gas producers to develop competing schemes, and the potential impact of duplication of facilities on resource conservation. The Board found that the need for enhanced gas processing facilities has been demonstrated; these facilities could be located at an existing compressor station site, as requested by Universal, or added to Czar's gas plant if suitable terms could be negotiated. Since such a negotiated settlement was not reached, the Board considers that development of reserves in the vicinity may justify 2 facilities in the future and the possible adverse economic effects from a new plant appear relatively small in this case. Accordingly, Universal's application was approved, but with a clause to terminate approval if construction does not begin within 1 year from the date of this decision.

19290 (NEB-SS—NE22-1/1988-9F) TransCanada PipeLines Ltd.. Reasons for decision. Application dated 5 February 1988 for tolls. (National Energy Board, Ottawa, Ontario (Canada)). 1988. 86p. (In French). (CE—02401). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C.

A hearing was held before the National Energy Board of Canada to consider various issues related to an application by TransCanada PipeLines on toll and tariff matters. The issues considered during the hearing included gas displacement and operating demand methodology, disposition of 1987 deferral account balances, availability of services, provision of fuel by shippers, tendering processes for company-use gas requirements, inclusion of sales and marketing matters in the tariff, toll schedules applicable in general and to specific kinds of service, availability of temporary winter service, and interpretation of tariffs and contracts. Decisions of the Board on these matters are given throughout this document. These decisions included rescinding a previous policy prohibiting self-displacement, crediting of 1987 credit balances to the 1988 cost of service, and amendment of various toll and tariff schedules. 1 tab.

19291 (NEB-SS—NE22-1/1988-9E) TransCanada PipeLines Ltd.. Reasons for decision. Application dated 5 February 1988 for tolls. (National Energy Board, Ottawa, Ontario (Canada)). 1988. 78p. (CE—02400). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C.

A hearing was held before the National Energy Board of Canada to consider various issues related to an application by TransCanada PipeLines on toll and tariff matters. The issues considered during the hearing included gas displacement and operating demand methodology, disposition of 1987 deferral account balances, availability of services, provision of fuel by shippers, tendering processes for company-use gas requirements, inclusion of sales and marketing matters in the tariff, toll schedules applicable in general and to specific kinds of service, availability of temporary winter service, and interpretation of tariffs and contracts. Decisions of the Board on these matters are given throughout this document. These decisions included rescinding a previous policy prohibiting self-displacement, crediting of 1987 credit balances to the 1988 cost of service, and amendment of various toll and tariff schedules. 1 tab.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 19279, 19290, 19291, 19455

19292 (SV-UG—1988-1) Service reliability and availability of distribution systems for natural gas. Svensson, B. (Swedish State Power Board, Vaellingby). 21 Dec 1987. 26p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757094/JAW.

The purpose of this report is to assess security of delivery of natural gas for Swedish distribution systems. A study is made of different models for analysis of service reliability and a presentation of concepts such as availability for components and system, fault tree analysis and life cost. The report presents statistics for service reliability from old Swedish town gas grids and ditto from Germany, the Netherlands and USA as well as electricity supply networks, water supply and sewer systems. Based upon statistics two alternatives are analyzed for construction of distribution grids; branch or ring feeding for a conjectured specific case. The conclusion is that ringfeeding gives a higher reliability but the difference concerning non delivered amount of gas per year statistically is so small that an economic evaluation is not relevant. An alternative view is presented as an assessment of maximum acceptable interruption time for gas delivery for different customers - heating versus outdoor temperature. (L.F.).

0340 Combustion

REFER ALSO TO CITATION(S) 19549, 19707, 19770

0350 Storage

REFER ALSO TO CITATION(S) 19455

19293 (SV-UG—1988-17) Storage of natural gas at high pressure in lined rock caverns - rock mechanical analysis. Aahrling, G.; Glamheden, R. (Swedish State Power Board, Vaellingby). 1 Feb 1988. 29p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757095/JAW.

This report summarizes the questions of rock mechanics which are connected with storing gas at high pressure in lined rock caverns. The following questions have been investigated: * necessary rock overburden, * deformation of the rock mass at high pressure, * the distance between two storage cylinders, * the drainage tunnels effect on the storage cylinder, * what fracture widths are expected when the storage cylinder is pressurized. The problems have been analysed with the aid of numerical computer programmes, FLAC and JOBFEM, and analytical calculations. (authors).

19294 (SV-UK—1987-9) Grouting in rocks - hydrogeological conditions and realization. Carlsson, A.; Lintu, Y.; Olsson, T. (Swedish State Power Board, Vaellingby). Apr 1987. 84p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757097/JAW.

This report deals with conceivable grouting methods and means to seal off rock cavities on great depths (600-800 metres). The main interests are focused upon some important questions such as: * sealing values, * grouting at high natural water pressures, * grouting with high grouting pressures, * grouting materials for natural gas storage. (With 29 refs.) (L.F.).

04 OIL SHALES AND TAR SANDS

19295 **(AOSTRA—1988) Alberta oil sands technology and research authority annual report, 1988.** (Alberta Oil Sands Technology and Research Authority, Edmonton (Canada)). 1988. 51p. (MICROLOG—88-05967). Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Alberta Oil Sands Technology and Research Authority (AOSTRA) is a provincial crown corporation whose mandate is to promote research and development relating to recovery and processing of oil sands products from Alberta's oil sand deposits, the recovery of heavy oils and enhanced recovery from conventional petroleum reservoirs. AOSTRA also promotes research into methods needed to ensure acceptable environmental quality after such recovery and processing operations. AOSTRA involvement in technology development ranges from fundamental, academic, and institutional research to the support of large-scale field pilots and demonstration units in cooperation with industry. This report reviews AOSTRA's activities for the year, including programs in in-situ recovery, underground testing, surface mining, cooperative research, technology transfer, oil sand waste processing, and produced water recycling. Recent highlights include oxygen combustion technology and fracturing injection methods developed at the Marguerite Lake Pilot Project, licensing of AOSTRA-owned Taciuk Direct Thermal Processor Technology for treating hydrocarbon-containing wastes, and tests of the VCC Process on bitumen and heavy oil. The report also includes a list of patents assigned to AOSTRA and financial statements. 2 tabs.

0403 Drilling, Fracturing, And Mining

19296 **(TM—8205) A Tarsands development solution: a second submission.** (Techman Ltd., Calgary, Alberta (Canada)). 1982. 124p. (CE—02319). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A study has been proposed to investigate development of an alternate and appropriate technology for the exploitation of Canadian oil sands. The study intended to find innovative approaches to mining oil sands, examine the size, location and technology of extraction, and determine appropriate upgrading technology consistent with the optimal approach to mining and extraction. Objectives of the study are to achieve substantial capital cost reduction per barrel of production, a scale of development which will encourage further optimization and innovation, and a development scheme within the capabilities of Canadian companies to manage and finance. This report includes an outline of a possible execution scenario for the project, and information on the oilsand-related experience of the company proposing this study. 4 figs.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 19296

19297 **(CONF-871198—5) Fluidized-bed gasification of an eastern oil shale.** Lau, F.S.; Rue, D.M.; Punwani, D.V.; Rex, R.C. Jr. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 7p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007165/JAW.

From Eastern oil shale symposium; Lexington, KY, USA (18 Nov 1987).

The current conceptual HYTORT process design for the hydroretorting of oil shales employs moving-bed retorts that utilize shale particles larger than 3 mm. Work at the Institute of Gas Technology (IGT) is in progress to investigate the potential of high-temperature (1100 to 1300 K) fluidized-bed gasification of shale fines (<3 mm size) using steam and oxygen as a technique for more complete utilization of the resource. Synthesis gas produced from fines gasification can be used for making some of the hydrogen needed in the HYTORT process. After completing laboratory-scale batch and continuous gasification tests with several Eastern oil shales, two tests with Indiana New Albany shale were conducted in a 0.2 m diameter fluidized-bed gasification process development unit (PDU). A conceptual gasifier design for 95% carbon conversion was completed. Gasification of 20% of the mined shale can produce the hydrogen required by the HYTORT reactor to retort 80% of the remaining shale. 12 refs., 1 fig., 5 tabs.

19298 **(NP—9770270) Continuous deashing of shale oil and normal pitch using supercritical extraction agents.** Fexer, W. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Technische Fakultaet). 2 Jun 1987. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770270/JAW.

The paper on hand deals with the quantitative separation of solid particles, suspended in viscous media such as shale oil and normal pitch, by means of the hypercritical fluid extraction. Because of the results of preliminary tests with semicontinuous equipment, a continuously working experimental apparatus for ash removal from viscous media was designed and built. For the determination of suitable operating parameters for ash removal from shale oil, phase equilibria in dependence from pressure and temperature were investigated in the quasiternary systems shale oil/toluene/propane, shale oil/tetralin/propane and shale oil/platform petrol/liquefied petroleum gas (LPG). The results showed that the quasiternary system shale oil/toluol/propane at a temperature of 120/sup 0/C and a pressure of 80 bar is already hypercritical with a toluol content of 10%. In heating up to 220/sup 0/C at constant pressure, the two-phase zone expands so much that for example a mixture of 10% by weight of toluol, 15% by weight of shale oil and 75% by weight of propane, which is at 120/sup 0/C a single-phase mixture, decomposes in a long-oil phase with 3% by weight of toluol, 84% by weight of oil and 13% by weight of propane and in a phase containing little oil with 12% by weight of toluol, 4% by weight of oil and 84% by weight of propane.

19299 **(UCRL—99703) Ammonia evolution from western and eastern oil shales.** Oh, M.S.; Crawford, R.W.; Foster, K.G.; Alcaraz, A. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 18p. (CONF-8804239—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006733/JAW.

From American Chemical Society meeting; Dallas, TX, USA (9 Apr 1988).

The study of nitrogen (N) species released during oil shale processing is an important research area because both oil shale and shale oil are rich in N. Combustion of N-bearing fuels can produce nitrogen oxides (NO/sub x/). Ammonia is a major N by-product in oil shale processing. The retort water and pyrolysis gases carry 4% and 0.2% of the total N, respectively, and ammonia accounts for most of the N in these product streams. Ammonia also accounts for half of N in the combustion gas stream, and NO/sub x/ for the other half. The concentrations of HCN and molecular nitrogen (N_2) in the combustion gas stream were not determined, so they were not included in the balance. The total N balance is poor, probably due to species not measured and to the lack of accuracy in determination of the N content in solids. We studied ammonia evolution by pyrolyzing oil shale under a given time-temperature history and measuring the total yield of ammonia by an ammonia electrode. In this paper, we summarize the on-line ammonia evolution rates for two Green River Formation oil shales and one Eastern oil shale under inert gas (argon) and also under steam. We analyze the contribution of the organic/inorganic sources of N to the NH_3 yield at different pyrolysis temperatures and show oil shale N-chemistry during pyrolysis. We also compare the kinetics of ammonia evolution with that of other pyrolysis gases. 29 refs., 5 figs., 2 tabs.

19300 **(UCRL—100230) Rates of chemical reactions that fix the distribution of sulfur in oil shale processing.** Taylor, R.W.; Morris, C.J.; Coburn, T.T. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 17p. (CONF-881128—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008030/JAW.

From Eastern oil shale symposium; Lexington, KY, USA (30 Nov 1988).

This report is a review of the chemistry of inorganic sulfur during recycle retorting of shales. Our goal was to learn what could be done utilizing conventional carbonate-based technology to minimize SO_2 from processing of eastern oil shale. Pyrite is the source of most of the sulfur in eastern shale. Pyrite decomposition during shale pyrolysis results in H_2S production, and during retorted-shale combustion both pyrite and pyrrhotite yield SO_2. We have measured the rate of capture of H_2S by carbonates and iron oxides. Iron oxides reacts with H_2S to form pyrrhotite, and the reaction is faster than the reaction of H_2S with dolomite. We have also measured the rate of SO_2 capture by mineral carbonates. We conclude that higher retorting and combustion temperatures and the circulation of high-surface-area dolomite or lime are necessary to reduce SO_2 emissions from the combustion of retorted eastern shale. Others have proposed to lower the sulfur content of retorted shale in preparation for combustion by steam oxidation of pyrrhotite. We suggest the use of CaO to accelerate this reaction by decreasing the concentration of the H_2S produced. 62 refs., 15 figs., 5 tabs.

0405 Properties And Composition

19301 **Influence of water-desaturation technique and stress on laboratory measurement of hydraulic properties of tight sandstones.** Chowdiah, P. (Inst. of Gas Technology, Chicago, IL (US)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 4, 679-685(Dec 1988).

Mercury porosimetry on unconfined sample chips and effective-gas-permeability measurements with evaporation used as the desaturating mechanism are two of the most common core-analysis measurements for tight sands. Data obtained with these two techniques have been compared with data on gas/water capillary pressure and effective gas permeability along a true drainage path at in-situ net confining stress. Results show that confining stress can have a significant effect on capillary pressure. Also, the use of evaporation to desaturate samples yields effective gas permeabilities much smaller than those obtained under true drainage conditions, suggesting that the evaporation method results in a pore-water distribution similar to that in an inhibition process.

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 19300

0409 Waste Research And Management

19302 **(ARC/NRD—8612) Assessment of fluid-rock interaction, as related to subsurface waste disposal, in oil sands and heavy oil areas of Alberta and adjacent areas. Phase 3. Final report.** Hitchon, B. (Alberta Research Council, Edmonton (Canada). Natural Resources Div.). 1986. 123p. (CE—02313). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Wastewaters sampled from twelve oil sands and heavy oil field pilots were analysed for their inorganic and organic constituents. The inorganic measurements were performed both in the field and in the laboratory; all similar groups of ions (e.g. alkali metals, halides) showed the same trends across the pilots. The highest concentrations of low molecular weight carboxylic acids were observed in wastewater samples from in-situ pilots where combustion extraction techniques are employed. Volatile hydrocarbons such as benzenes and aliphatics were detected in the wastewaters. The water-soluble organics were extracted from the wastewaters as two fractions and analysed separately. The major components of the acid fraction were: phenols, benzoic acids, dihydroxybenzenes, hydroxyindans and naphthols. The major base/neutral constituents were: aromatic, aliphatic and cyclic hydrocarbons, higher homologs of phenol, ketones, aldehydes, esters and nitrogen- and sulfur-containing compounds. The adsorption of phenol by two Alberta formations, one carbonate and one sandstone, was studied under varying conditions of redox, ionic strength, solid-to-liquid ratio, and total organic carbon of the rock. Adsorption of phenol was found to depend on the solid-to-liquid ratio, formation lithology, and ionic strength. A study of adsorption kinetics showed very fast adsorption with no desorption for the remainder of the experiment (10 days). 14 refs., 34 figs., 32 tabs.

19303 **(ARC/NRD—8612) Assessment of fluid-rock interaction, as related to subsurface waste disposal, in oil sands and heavy oil areas of Alberta and adjacent areas. Part 1 - final report.** Hitchon, B. (Alberta Research Council, Edmonton (Canada). Natural Resources Div.). 1985. 182p. (CE—02314). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The various technologies associated with in situ extraction of crude bitumen from oil sands deposits, heavy oil recovery schemes, and deep injection of wastes from these industrial plants, may all lead to man-imposed fluid-rock interaction in the respective oil sands and heavy oil areas. The objective of this study is to identify and assess the nature of these fluid-rock reactions in the oil sands and heavy oil areas of Alberta and adjacent areas. Four oil sands and heavy oil study areas were selected for a regional reconnaissance and evaluated with respect to their geology, hydrology and constraining economic resources. Deep aquifers in the regional flow regime were then identified and for three of the areas the shallowest was investigated in more detail. Structure contour and isopach maps of the aquifer and adjacent aquitards delineate the geometry, and hydraulic-head distribution, hydraulic conductivity (log K) and salinity maps the hydrodynamics and hydrochemistry. This information was supplemented by hydraulic-head cross-sections, pressure-elevation plots and temperature-depth graphs. 53 refs., 106 figs., 7 tabs.

19304 **(DOE/MC/11076—2658) A summary of research on oil shale solid waste conducted by the Western Research Institute.** Essington, M.E.; Bowen, J.M.; Mason, G.M. (Western Research Inst., Laramie, WY (USA)). Aug 1988. Contract FC21-86MC11076. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000933/JAW.

The objectives of the research are to characterize in detail the physical, chemical, and mineralogical properties of spent oil shales and to identify the processes that control element and compound behavior in spent oil shale disposal environments. Areas of research include the determination of oil shale and spent oil shale mineralogy, the chemical characterization of spent oil shale leachates, the solubility analysis of trace element-bearing minerals, and the characterization of trace element and trace organic absorption by spent oil shales. The data are evaluated by geochemical models selected for their ability to model spent oil shale systems using critically evaluated thermodynamic data. Methods to validate geochemical model predictions are also developed. Because this report only summarizes research results and conclusions, it includes lists of related publications that present detailed findings, as well as experimental methodologies and discussions. 1 fig.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 20117

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 20135, 21323

0505 Uranium Enrichment

REFER ALSO TO CITATION(S) 19313, 19396, 20137

19305 **(EUR—11486) Uranium enrichment by gas centrifuge.** Heriot, I.D. (Urenco Ltd., Marlow (UK)). (Commission of the European Communities, Luxembourg). 1988. 141p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757198/JAW.

After recalling the physical principles and the techniques of centrifuge enrichment the report describes the centrifuge enrich-

ment programmes of the various countries concerned and compares this technology with other enrichment technologies like gaseous diffusion, laser, aerodynamic devices and chemical processes. The centrifuge enrichment process is said to be able to replace with advantage the existing enrichment facilities in the short and medium term. Future prospects of the process are also described, like recycled uranium enrichment and economic improvements; research and development needs to achieve the economic prospects are also indicated. Finally the report takes note of the positive aspect of centrifuge enrichment as far as safeguards and nuclear safety are concerned. 27 figs, 113 refs.

19306 **(UCRL—53912) The prediction of the centerline density of an atomic beam of mercury issuing from a finite-slit-shaped converging nozzle.** Bahowick, S.M. (Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008647/JAW.

The centerline density of an atomic beam of mercury issuing from a finite-slit-shaped converging nozzle is predicted using either the existing method of characteristics correlation for the infinite slit or an axisymmetric effusive flow equation modified to represent a finite slit. The centerline density is then experimentally measured using laser absorption techniques. 31 refs., 5 figs., 2 tabs.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 19313, 19993, 20121, 20144, 20145, 20734, 21240, 21241, 21243, 21326, 21441

19307 **(CONF-880613—28) The effect of crystal structure stability on the mobility of gas bubbles in intermetallic uranium compounds.** Rest, J.; Hofman, G.L.; Birtcher, R.C. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007417/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, USA (27 Jun 1988).

Irradiation experiments with certain low-enrichment, high-density, uranium-base intermetallic alloys that are candidate reactor fuel materials, such as U_3Si and U_6Fe, have revealed extraordinarily large voids at low and medium fuel burnup. This phenomenon of breakaway swelling does not occur in other fuel types, such as U_3Si_2 and UAl_3, where a distribution of relatively small and stable fission gas bubbles forms. In situ transmission electron microscope observations of ion radiation-induced rapid swelling of intermetallic materials are consistent with growth by plastic flow. Large radiation enhancement of plastic flow in amorphous materials has been observed in several independent experiments and is thought to be a general materials phenomenon. The basis for a microscopic theory of fission gas bubble behavior in irradiated amorphous compounds has been formulated. The assumption underlying the overall theory is that the evolution of the porosity from that observed in the crystalline material to that observed in irradiated amorphous U_3Si as a function of fluence is due to a softening of the irradiated amorphous material. Bubble growth in the low-viscosity material has been approximated by an effective enhanced diffusivity. Mechanisms are included for the radiation-induced softening of the amorphous material, and for a relation between gas atom mobilities and radiation-induced (defect-generated) changes in the material. Results of the analysis indicate that the observed rapid swelling in U_3Si arises directly from enhanced bubble migration and coalescence due to plastic flow. 34 refs., 11 figs.

19308 **(DPST—88-1036) Experimental data for the Uranium Solidification Facility (USF) flowsheet.** Boss, S.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 22 Dec 1988. Contract AC09-76SR00001. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007946/JAW.

Based on an experiment to determine the compositional change of a UO2(NO3)2-HNO3-H2O solution upon boiling, the USF flowsheet for the magnesium nitrate system proposed by Oak Ridge does not appear to accurately model the process. In the experiment, it was found that Oak Ridge's Mg(NO3)2-HNO3-H2O model inaccurately predicts the NO3 molarity for a given concentration of the salt. A triangular composition diagram acquired from Hanford is a more representative model of the behavior of the UNH system. Our experimental data agrees more closely with the triangular composition model. The new data can be used to predict approximate concentrations expected for the liquid streams into and out of each piece of equipment in the USF process. The vapor stream compositions cannot be predicted because the liquid and vapor phases were not in equilibrium throughout the experiment. For the specific gravities of the various streams proposed by Oak Ridge. The compositions for the high acid case, which is the most conservative case in terms of corrosion effects, have been agreed upon by Oak Ridge. Corrosion studies utilizing the high acid data for the wiped-film evaporator and the denitrator are currently being performed. 4 figs., 3 tabs.

19309 **(FMPC—2158) Non-destructive identification of unidentified radioactive materials using multiple data inputs.** Mihalovich, G.S. (Westinghouse Materials Co. of Ohio, Cincinnati (USA)). 1989. Contract AC05-86OR21600. 10p. (CONF-890207—2-Abst.). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006638/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

The Feed Materials Production Center (FMPC), is a Department of Energy (DOE) facility, that produces high purity uranium for defense programs. It also serves as the DOE's repository for temporary storage of thorium materials. The containers storing the thorium materials have suffered from extensive environmental deterioration and with the passing of time records have been lost. The net result is that a significant number of containers have lost their identifying markings. The exact type of materials in some of the containers is unknown. The containers must be repackaged for Environmental Safety and Health (ES&H) reasons. Prior to repackaging the identity of the contents must be ascertained. However, these containers cannot be opened due to As Low As Reasonably Achievable (ALARA) and ES&H considerations. A method was developed to determine the content of the containers, without physical inspection, prior to the repackaging/overpacking. This method utilizes a computer based data base management system which incorporates statistical analysis of the available input data and assigns statistical weighting to the various inputs, based on the significance of the data. The data consists of the following: historical data on the containers, if it exists; the weight of the containers and materials; the gamma energies related to the various materials; the geometry of the container and materials; the absorption coefficients of the materials and containers; the self-shielding of the materials; external contamination data, if any; and any other data obtained either prior to or during the overpacking effort. This system will work not only for the thorium materials, but the system has the capability to perform similar functions at other facilities faced with similar concerns. 2 refs., 3 figs., 1 tab.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 20113

19310 **(ENEA-RT-COMB—88-6) SEPI an expert system for plant design. An application to fuel cycle.** Carotenuto, M.; Corleto, P.; Landeyro, P. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 74p. (In Italian). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705435/JAW.

The availability and suitability of technological information is of great importance in every kind of design task, especially when safety and reliability considerations are involved. In this paper an "expert system for plant design" (SEPI), is presented, together with its first application to nuclear back-end plants. This system is available on ENEA computer network. It is thought to be used both to collect know-how developed in the field and to assist unskilled designers during selection, evaluation and dimensioning tasks. It attemps to reproduce the normal way of "reasoning" and acting, and provides some graphic facilities.

19311 **(JAERI-M—88-133) Outline of an experimental apparatus for the study on the tritiated water recycle process.** Maeda, Mitsuru; Sugikawa, Susumu; Fujine, Sachio; Uchiyama, Gunzou; Tsujino, Takeshi; Ohtou, Yoshihiro; Ai, Hironobu; Suyama, Naohiro. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 128p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756901/JAW.

Fundamental experiments were conducted on the tritiated water recycle process. The report presents a summary of the experimental apparatus, including descriptions of process conditions and dimensions of major process equipments in the main process of tritium scrubbing, feed solution preparation and aqueous waste treatment, and descriptions of safety design philosophy such as safety considerations in normal and accident conditions.

19312 **(JAERI-M—88-188) Development of partitioning method. Separation and recovery of the platinum group elements and technetium from spent fuel (literature survey).** Kubota, Kazuo; Dojiri, Shigeru; Kubota, Masumitsu. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 121p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756906/JAW.

The literature survey was carried out on the amount of natural resources, behaviors in reprocessing process and in separation and recovery methods of the platinum group elements and technetium which are contained in spent fuel. The essential results are described below. (1) The platinum group elements, which are contained in spent fuel, are quantitatively limited, compared with total demand for them in Japan. And estimated separation and recovery cost is rather high. In spite of that, development of these techniques is considered to be very important because the supply of these elements is almost from foreign resources in Japan. (2) For recovery of these elements, studies of recovery from undisolved residue and from high level liquid waste (HLLW) also seem to be required. (3) As separation and recovery methods, following techniques are considered to be effective; lead extraction, liquid metal extraction, solvent extraction, ion-exchange, adsorption, precipitation, distillation, electrolysis or their combination. (4) But each of these methods has both advantages and disadvantages. So development of such processes largely depends on future works. (author) 94 refs.

19313 **(RFP—4270) Process chemistry technology: Annual progress report, 1 October 1986--30 September 1987.** Crisler, L.R. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1 Dec 1988. Contract AC04-76DP03533. 45p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008200/JAW.

Progress is briefly reported on research programs from Rocky Flats Plant. Areas of research include: product physical chemistry, pyrochemistry, and aqueous recycle technology. Research topics discuss various programs in plutonium alloys, enriched uranium, and various plutonium recycle/recovery programs. (CBS)

0509 Transport And Storage

REFER ALSO TO CITATION(S) 19415, 19417, 19425

19314 **(INIS-BR—1405) Management and transport of radioactive wastes in Goiania, Brazil.** Xavier, A.M.; Mezrahi, A. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ). 1988. 11p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705517/JAW.

The radiological accident occured in Goiania, which has led to the liberation to the environment of c.l.350 Ci of Cs-137, demanded the formulation of special procedures related to waste management and transport of radioactive materials to a provisory storage facility. The main objectives of the present article are to describe the work performed in the above mentioned fields and to point out the basic needs for Brazilian research and development in the areas of waste treatment and design and testing of packages.

19315 **(NUKEM-FuE—84027) Studies of long-term influences on intact spent fuel rods under conservative dry-storage conditions. Final report.** Porsch, G. (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1985. 236p. (In German). Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.).

In cooperation with DWK, KWU, and the Ispra Research Center, a dry-storage experiment was carried out with 10 spent PWR and 15 spent BWR fuel rods. The storage temperatures ranged up to 450/sup 0/C, the storage time extended over three cycles with a total duration of 16.5 months. The experimental work was conducted with specially developed test equipment in the hot cells at the ESSOR reactor in the research center operated by the European Community in Ispra, Italy. The gamma-spectrometric analyses of the storage atmospheres ruled out any defect during the storage. Visual inspections and eddy current tests after storage confirmed the integrity of the test material. The krypton-85 activity detected in the storage atmosphere inside the container holding BWR fuel rods could be attributed to a contamination of the fuel rod surface with uranium. During absolutely oxygen-free storage, the thickness of the oxide layer remained unchanged, while during storage with a limited amount of oxygen available it was possible to correlate the increase in thickness of the oxide layer with the amount of oxygen consumed. The creep of the cladding tube remained in all less than one percent. Quantitatively, the results can be described to a good approximation by an empirical creep formula. By means of beta-spectrometric analyses of the storage atmospheres, it was possible to detect tritium in the chemical compounds HT and HTO. The equilibrium concentrations calculated with a simple model (Sieverts' Law) showed good agreement between theory and experiment. A fuel rod internal pressure measurement made at eight rods, and metallographic studies of cladding tube sections, completed the experimental program. (orig.) With 90 figs., 35 tabs., 13 refs.

19316 **(ORNL/TM—11008) Shipping and storage cask data for spent nuclear fuel.** Johnson, E.R.; Notz, K.J. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 65p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007884/JAW.

This document is a compilation of data on casks used for the storage and/or transport of commercially generated spent fuel in the US based on publicly available information. In using the information contained in the following data sheets, it should be understood that the data have been assembled from published information, which in some instances was not internally consistent. Moreover, it was sometimes necessary to calculate or infer the values of some attributes from available information. Nor was there always a uniform method of reporting the values of some attributes; for example, an outside surface dose of the loaded cask was sometimes reported to be the maximum acceptable by NRC, while in other cases the maximum actual dose rate expected was reported, and in still other cases the expected average dose rate was reported. A summary comparison of the principal attributes of storage and transportable storage casks is provided and a similar comparison for shipping casks is also shown. References to source data are provided on the individual data sheets for each cask.

19317 **(PNL—6706) COBRA-SFS modifications and cask model optimization.** Rector, D.R.; Michener, T.E. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 236p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007684/JAW.

Spent-fuel storage systems are complex systems and developing a computational model for one can be a difficult task. The COBRA-SFS computer code provides many capabilities for modeling the details of these systems, but these capabilities can also allow users to specify a more complex model than necessary. This report provides important guidance to users that dramatically reduces the size of the model while maintaining the accuracy of the calculation. A series of model optimization studies was performed, based on the TN-24P spent-fuel storage cask, to determine the optimal model geometry. Expanded modeling capabilities of the code are also de-

scribed. These include adding fluid shear stress terms and a detailed plenum model. The mathematical models for each code modification are described, along with the associated verification results. 22 refs., 107 figs., 7 tabs.

19318 **Resolution of shipper-receiver differences.** Weber, J.H. (E.I. du Pont de Nemours and Co., Savannah River Plant, Aiken, SC (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 824-827(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Every facility strives to comply with DOE Order 5630.2 requiring independent and timely measurements of between facility shipments. While it is desirable to resolve shipper-receiver (S/R) differences before processing any of the material, this is not always possible or practical. Two examples are discussed where there is an apparent measurement bias between the shipping and receiving facilities. This measurement bias persisted over several shipments resulting in more S/R differences outside the combined error limits than expected. For the first example, the receiver could not measure the material until processed. In the second example, the receiving facility made NDA measurements of the shipments before processing. While no definite answer exists that will resolve S/R differences in all situations, the examples presented of studies and investigations to identify biases and verify the integrity of the measurements could be applied at other facilities.

19319 **VACOSS/MIVS interface system - Field trial configuration.** Richter, B.; Stein, G.; Johnson, C.; Martinez, R. (Kernforschungsanlage Juelich, Juelich (DE); Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 899-901(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Federal Republic of Germany (FRG) VACOSS Electronic Seal and the US Modular Integrated Video System (MIVS) have been successfully interfaced and demonstrated to several FRG facility operators and the IAEA and EURATORM Safeguards authorities. In the very near future, this system, which is intended to reduce inspection effort while maintaining existing safeguards assurances, will undergo field evaluation. This system provides an example of a way in which Containment and Surveillance (C/S) can achieve an increased importance in the attainment of effective International Safeguards. This paper describes the VACOSS Video Interface System and how it may be used by inspectors and facility operators as part of the safeguard program for nuclear material transport.

0510 Marketing, Economics, And By-products

19320 **(RFP—4295) Plutonium operations computer integrated manufacturing design concept.** Hausburg, D.E.; Ballenger, R.J. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1989. Contract AC04-76DP03533. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008091/JAW.

Selected managers, engineers, and computer users were designated to provide direction for implementing Computer Integrated Manufacturing within Plutonium Operations. Using tangible and intangible benefits as a measure, four major projects were identified for implementation. Descriptions of these projects were completed and are now incorporated in the Rocky Flats Plant Computer Integrated Manufacturing project tracking system. This report covers the four major projects, reviews Plutonium Operations processes and procedures, and recommends future actions.

0520 Waste Management

REFER ALSO TO CITATION(S) 19309, 19312, 19314, 19320, 19392, 20209, 20556, 20557, 20558, 20559, 20614, 20622, 20743, 21322, 21560

19321 **(AEEW-M—2429) Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. First semestrial report July - December 1986.** Donoghue, S.J.; Howard, C.G.; Lee, D.J. (UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div.). Jun 1987. 25p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705397/JAW.

An account of the annual decontaminations undertaken on the SGHWR at Winfrith is given with reasons for changing from Citrox reagents to LOMI plus the effects of using nitric acid permanganate solution as a preoxidising agent. Safe disposal of these reagents after use is a problem concerning many water cooled reactor operators. A brief review of the various methods of disposal is given. The proposed method of disposing of LOMI wastes generated at Winfrith is to remove the activity onto ion exchange resins then immobilize them in a cement matrix. Duolite C225 (a cross linked polystyrene with sulphonic acid functional groups) has been identified as a suitable ion exchanger. Duolite C225 in the sodium form can be successfully immobilised in blended cement systems. The formulation which appears acceptable is manufactured from a 9 to 1 blend of Blast Furnace Slag and Ordinary Portland Cement, containing 40% ion exchange resin by weight, in the form of a slurry. The product has adequate strength for handling and shows little dimensional change with time. Experiments show that above 50% waste loading the product becomes unstable and its strength is unacceptably low. Changes in the metal cation have shown little effect on the properties of the product. Increasing the waste loading appears to have little effect on the hydration rate of the product. Preliminary calculations show that a volume reduction factor of 4 is obtained by taking the active LOMI effluent, removing the activity onto the Duolite C225 and then immobilising in cement.

19322 **(AEEW-R—2206) Immobilisation of shredded waste in a cement matrix. Progress report 1984/85.** James, J.M.; Smith, D.L. (UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div.). Oct 1987. 69p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705950/JAW.

The work covered in the period of this report was aimed at proving the infilling capabilities of waste packages containing shredded paper and plastic simulant waste material held in a basket. The programme required the production of 200 and 500 litre packages and a demonstration that infilling could be attained to give a minimum of voidage in the completed cemented product. The procurement, testing and fitting of level detectors was an important part of this work to demonstrate a means of controlling the process to prevent overfilling of the packages. Evaluation of full-scale cemented products was required to confirm previously reported properties of density and homogeneity in packages produced by the reference encapsulation process and to demonstrate package integrity under sea-disposal conditions. A standard feedstock for the continuity of a long-term programme was required. Such a product, based on an analysis of arisings from plutonium gloveboxes, was produced in bulk and characterised. The previously observed movement of waste during infilling, due to its low density compared with that of the infill grout, required further assessment. During the period, 200, 400 and 500 litre drums required for future active infilling trials were modified and despatched to AERE Harwell for waste loading. These drums were fitted with level detectors and with grout spreader troughs which had been identified during the development programme. A prototype automated Grout Infill Test Rig designed by BNF plc was delivered to Winfrith towards the end of the period for practical assessment trials.

19323 **(AERE-R—13100) NAPSAC lattice modelling option (release 1A).** Kingdon, R.D.; Herbert, A.W. (UKAEA Harwell Lab. Theoretical Physics Div.). Aug 1988. 30p. H.M. Stationery Office, London, price Pound 10.00.

Release 1A of the lattice modelling option of the NAPSAC code is described. Detailed examples for its application to percolation and network flow problems are given.

19324 **(BNL—52125) An experimental survey of the factors that affect leaching from low-level radioactive waste forms.** Dougherty, D.R.; Pietrzak, R.F.; Fuhrmann, M.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). Sep 1988. Contract AC02-76CH00016. 247p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008842/JAW.

This report represents the results of an experimental survey of the factors that affect leaching from several types of solidified low-level radioactive waste forms. The goal of these investigations was to determine those factors that accelerate leaching without changing its mechanism(s). Typically, although not in every case,the accelerating factors include: increased temperature, increased waste loading (i.e., increased waste to binder ratio), and decreased size (i.e., decreased waste form volume to surface area ratio). Additional factors that were studied were: increased leachant volume to waste form surface area ratio, pH, leachant composition (groundwaters, natural and synthetic chelating agents), leachant flow rate or replacement frequency and waste form porosity and surface condition. Other potential factors, including the radiation environment and pressure, were omitted based on a survey of the literature. 82 refs., 236 figs., 13 tabs.

19325 **(CONF-881011—39) The effect of liner hydraulic conductivity on disposal cell performance.** Yu, C.; Yuan, Y.C.; Chia, Y.P. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007386/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

Multilayered disposal cells are frequently used for the disposal of radioactive and hazardous wastes. These disposal cells consist of materials with different permeabilities that are placed in various thicknesses at the bottom as well as in the cover of the cell. Typically, a layer of permeable material is placed above a layer with low permeability; the permeable layer functions as a drainage/leachate collection system and the low-permeability layer functions as a migration barrier/liner. This paper analyzes the effects of infiltration through unsaturated soil liners on the long-term performance of the disposal cell. 3 refs., 1 fig., 1 tab.

19326 **(CONF-881054—48) Survey of DOE NDA practices for CH-Tru waste certification--illustrated with a greater than 10,000 drum NDA data base.** Schultz, F.J.; Caldwell, J.T.; Smith, J.R. (Oak Ridge National Lab., TN (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC05-84OR21400;AC07-76ID01570. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007213/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

We have compiled a greater than 10,000 CH-TRU waste drum data base from seven DOE sites which have utilized such multiple NDA measurements within the past few years. Most of these nondestructive assay (NDA) technique assay result comparisons have been performed on well-characterized, segregated waste categories such as cemented sludges, combustibles, metals, graphite residues, glasses, etc., with well-known plutonium isotopic compositions. Waste segregation and categorization practices vary from one DOE site to another. Perhaps the most systematic approach has been in use for several years at the Rocky Flats Plant (RFP), operated by Rockwell International, and located near Golden, Colorado. Most of the drum assays in our data base result from assays of RFP wastes, with comparisons available between the original RFP assays and PAN assays performed independently at the Idaho National Engineering Laboratory (INEL) Solid Waste Examination Pilot Plant (SWEPP) facility. Most of the RFP assays were performed with hyperpure germanium (HPGe)-based SGS assay units. However, at least one very important waste category, processed first-stage sludges, is assayed at RFP using a sludge batch-sampling procedure, prior to filling of the waste drums. 5 refs., 5 figs.

19327 **(CONF-890207—4) An overview of the ORNL waste handling and packaging plant, a major processing facility for remote-handled transuranic waste.** Brown, C.H. Jr.; Berry, J.B.; Turner, D.W. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007203/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

The Waste Handling and Packaging Plant (WHPP) is identified as a key element in the US Department of Energy's transuranic (TRU) waste program for both remote handled (RH) and special case (SC) waste. The mission of the facility is to retrieve, receive, repackage, certify, and ship TRU waste to the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico. The conceptual design of the WHPP was initiated in March 1988 and the final report will be issued at the end of May 1989. The development activities to support the WHPP were initiated during the summer of 1988 and will continue to provide technical information and data to the project over the next several years. An environmental assessment for the WHPP is planned and will be issued in 1990. A summary of each of these areas will be provided in this paper. 9 refs., 9 figs.

19328 **(CONF-890207—5) Experience with the tumulus technology for the disposal of solid low-level radioactive waste.** Garland, S.B. II; Van Hoesen, S.D.; Scanlan, T.F. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007200/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

As part of the development of a long-range plan for the disposal of solid low-level radioactive waste, Martin Marietta Energy Systems, Inc., has built a full-scale tumulus facility as a technology demonstration. This aboveground facility consists of a concrete pad on which the waste is placed, a synthetic underpad liner, concrete disposal vaults to contain the waste, a performance monitoring system, and a multilayered cap to be constructed after the pad is filled. Waste has already been placed on the pad, and the suitability of the design, the construction, and the operating procedures has been assessed. The facility appears to be acceptable with the exception of the underpad liner which will be eliminated in subsequent tumulus facilities. Radiation monitoring of the workers and environmental monitoring have shown essentially no impacts above background. Although a final assessment of the tumulus technology must await an evaluation after construction of the cap, plans are proceeding to construct additional tumulus facilities. 3 refs., 1 fig., 2 tabs.

19329 **(CONF-890207—6) Legal and regulatory issues regarding classification and disposal of wastes from actinide partitioning and transmutation.** Kocher, D.C. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007198/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

Partitioning and transmutation of actinide radioelements in spent nuclear fuel from civilian power reactors is potentially attractive because the resulting wastes might be acceptable for disposal using systems which are considerably less costly than a deep geologic repository. At present, there are no legal or regulatory prohibitions to seeking alternatives to a geologic repository for disposal of such wastes. However, additional laws and regulations would be needed, and the Nuclear Regulatory Commission has been reluctant to alter the current framework for radioactive waste management, in which geologic repositories or near-surface facilities are the only disposal options established in law and regulations unless a compelling need for alternatives with intermediate waste-isolation capabilities is demonstrated. There are also important technical considerations which are not encouraging with regard to the development of intermediate disposal systems for wastes from partitioning and transmutation of actinides in civilian spent fuel. First, the wastes may contain sufficient concentrations of fission products. Second, defense reprocessing wastes may contain sufficient concentrations

of fission products and long-lived actinides. Thus, in developing the legal and regulatory framework for alternative disposal systems, there is a need to establish maximum concentrations of fission products and long-lived actinides that would be acceptable for intermediate disposal. 19 refs.

19330 **(DOE/ER/45145—4) Physical chemistry of portland-cement hydrate, radioactive-waste hosts: Final report, January 16, 1987--December 31, 1987.** Grutzeck, M.W. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). 15 Jan 1989. Contract FG02-84ER45145. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008080/JAW.

This is a final report summarizing the results of a study of the physical and crystal chemistry of potential hydroxylated radioactive waste hosts compatible with portland cement. Research has focussed on the identification and evaluation of hydrated host phases for four ions: cesium, strontium, iodine and boron. These ions were chosen because they are among the most long lived of the radioactive waste ions as well as the most difficult to immobilize with cement-based materials. Results show that such phases do indeed exist, and that they are excellent host phases for the above ions.

19331 **(DOE/ID/12649—2-Vol.1) Prototypical spent nuclear fuel rod consolidation equipment: Phase 2, Final design report: Volume 1, Detailed design.** Blissell, W.H.; Ciez, A.P.; Goedicke, F.E.; Bessko, C. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Waste Dept.). 22 Dec 1987. Contract AC07-86ID12649. 515p. NTIS, PC A22/MF A01 - OSTI; 1; GPO Dep. Order Number TI89006184/JAW.

This document describes the Westinghouse Final Design for the Prototypical Spent Fuel Consolidation Equipment Demonstration Project. This design represents a fully qualified, licensable, cost effective spent fuel rod consolidation system. As a result of significant concerns raised by DOE and its Technical Review Committee during the 30% Design Review, significant changes were made to the original Preliminary Design resulting from Phase I activities. These changes focused on increased automation, end fitting removal, the rod pulling process and the need to maintain the consolidation canisters as clean as possible. As a result of these changes, the new system is greatly enhanced with a much greater probability of meeting or exceeding the project functional requirements. As a result of delays in resolving cost and contractual differences, additional bench testing was not conducted during Phase II. It is however our belief that the current design exceeds the 90% confidence level required by DOE because of the confidence gained from the Phase I tests, the additional engineering detail completed and the fact that our rod pulling tool has been demonstrated in a similar application at Oconee while our ID tube cutter is a modified (mounting method only) off-the-shelf design. 7 refs., 49 figs., 36 tabs.

19332 **(DOE/ID/12649—2-Vol.3) Prototypical spent nuclear fuel rod consolidation equipment: Phase 2, Final design report: Volume 3, Appendices: Part 2.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Waste Dept.). 22 Dec 1987. Contract AC07-86ID12649. 1477p. NTIS, PC A99 - OSTI. Order Number TI89006186/JAW.

The purpose of this report is to identify and analyze a range of credible events and accident occurrences (from minor to the design basis accidents) and their causes and consequences. For each situation, the considerations to prevent or mitigate the event or accident are to be addressed. The report includes a description of the approach used to identify the potential events or accidents (Section 3.0), a discussion of Off-Normal Events (Section 4.0), and finally a discussion of Accidents (Section 5.0).

19333 **(DOE/ID/12649—2-Vol.4) Prototypical spent nuclear fuel rod consolidation equipment: Phase 2, Final design report: Volume 4, Appendices: Part 3.** Ciez, A.P. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Waste Dept.). 22 Dec 1987. Contract AC07-86ID12649. 1114p. NTIS, PC A99 - OSTI. Order Number DE89006187/JAW.

The purpose of this manual is to provide assembly, installation, operation, maintenance, and off-normal recovery procedures for the Consolidation Equipment. The Consolidation System is a horizontal, dry system capable of processing one Pressurized Water Reactor (PWR) fuel assembly or one Boiling Water Reactor (BWR) fuel assembly at a time. The system will process all spent PWR and BWR fuels from the commercial US nuclear power reactor industry. Component changeouts for various fuel types have been minimized to reduce costs, required in-cell module storage space, and to increase efficiency by decreasing set-up time between fuel consolidation campaigns. The most important feature of the Westinghouse system is the ability to control the fuel rods at all times during the consolidation process from rod extraction, through canister loading. This features assures that the rods from two PWR fuel assemblies or four BWR fuel assemblies (minimum) can be loaded into one consolidated rods canister.

19334 **(DOE/ID/12649—2-Vol.5) Prototypical spent nuclear fuel rod consolidation equipment: Phase 2, Final design report: Volume 5, Drawing package.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Waste Dept.). 22 Dec 1987. Contract AC07-86ID12649. 304p. NTIS, PC A14 - OSTI. Order Number TI89006188/JAW.

This volume contains only engineering drawings for the equipment. (TEM)

19335 **(DOE-RW—88.070) Further investigations of the properties of polymer modified cements.** Johnson, D.I. (UKAEA Harwell Lab. Materials Development Div.). (Department of the Environment, London (UK)). May 1988. 47p. (AERE-R—12829). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705964/JAW.

This report concludes the work done on behalf of the Department of the Environment on polymer modified cement composites. Topics covered include: the influence of cure schedule on flexural properties, observation of the onset and cracking during flexural testing, measurement of water permeability and caesium diffusion rates, and the use of Back Scattered Electron Imaging to identify the polymer phase. The properties of epoxide resin modified cements in the previous report were disappointing. Air entrainment of the mixing stage was a likely cause of the poor performance of these products and procedures to overcome this problem were devised. The range of polymer additives investigated was broadened by the inclusion of modified acrylic latexes and a polymensable acrylate resin additive. Properties for OPC and 9 BFS: 1 OPC cements are compared and the modification of properties achieved by polymer additions to both cement systems is discussed.

19336 **(DOE-RW—88.087) Site descriptions for preliminary radiological assessments of low-level waste repositories.** Burgess, W.E.; Jones, C.H.; Sumerling, T.J.; Ashton, J. (Associated Nuclear Services, Epsom (UK)). (Department of the Environment, London (UK)). Jul 1988. 271p. (ANS-R—689-2). NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS. Order Number DE88705430/JAW.

The environmental contexts of four sites, previously under investigation by UK Nirex Ltd. as potential locations for low-level waste disposal facilities, are described. Information on geographical setting, climate, surface hydrology, land use, agriculture, fisheries, geology and hydrogeology is presented. The geological and hydrogeological data are interpreted with the support of deterministic modelling of groundwater conditions. The routes by which radionuclides may migrate from the site are identified and reduced to 1D statistical descriptions suitable for use in probabilistic risk assessments. Additional data required to improve the assessment of the performance of the site are identified.

19337 **(DOE/RW—0188-3) Quarterly report on program cost and schedule: Fourth quarter FY 1988.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). 1988. 37p. H. Order Number TI89008332/JAW.

Major program milestones completed in the fourth quarter of FY 1988 include completed preliminary draft NWPAA Section 175 Impacts Report, completed Title I ESF design, completed site reclamation in Texas, distributed review draft of the Dry Cask Storage Study, completed draft and final FY 1990 OMB budget, issued FY 1987 Annual Report to Congress, issued four draft Environmental Field Activity Plans, issued draft Environmental Pro-

gram Overview, and made grant payments to local governments under Section 116 of NWPA, as amended. Major accomplishments during the fourth quarter of FY 1988 are listed. The Water Appropriation Permit Application was filed with the Nevada State Engineer on July 21, 1988. Installation and checkout of the Prototype Engineered Barrier Test equipment in G-tunnel is continuing with an expected early September test initiation data. The Configuration Management Plan was sent to DOE/HQ for approval. The prototype facility for testing the horizontal waste package emplacement configuration was completed in the G-tunnel.

19338 **(DOE/WIPP—85-001-Rev.3) Operations program plan: Revision 3.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jul 1988. Contract AC04-86AL31950. 316p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008570/JAW.

This document, the Operations Program Plan (OPP), has been developed as the seven-year master plan for operation of WIPP. The OPP was authorized by the Albuquerque Field Office of the Department of Energy (DOE-AL) and that organization's WIPP Project Office (DOE-WPO) in Carlsbad, New Mexico. The OPP is the directive from the DOE-WPO Project Manager as to how the WIPP is to be managed, operated, and administered. As the top tier management document for WIPP, the OPP establishes organizational responsibilities and an organizational structure for the Waste Isolation Division (WID) of Westinghouse Electric Corporation. The OPP sets policy and tone for conducting WIPP operations; it requires and specifically authorizes implementing documents (e.g., manuals). It has also proven instrumental in the budgeting and planning process, most particularly in expediting the preparation of specific budgets and detailed schedules for each of the numerous work packages. The OPP is also used to communicate information about WIPP operations.

19339 **(DOE/WIPP—89-004) TRUPACT-II content codes (TRUCON): Revision 0.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Feb 1989. Contract AC04-86AL31950. 273p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008270/JAW.

The Transuranic Package Transporter (TRUPACT-II) Content Codes document (TRUCON) represents the development of a new content code system for shipping contact handled transuranic (CH-TRU) waste in TRUPACT-II. It will be used to convert existing waste forms, content codes, and any other identification codes into a system that is uniform throughout for all Department of Energy (DOE) sites. These various codes can be grouped under the newly formed shipping content codes without any loss of waste characterization information. The TRUCON document provides a parametric description for each content code for waste generated and compile this information for all ten DOE sites. Compliance with waste generation, processing and certification procedures at the sites (outlines in the TRUCON document for each content code) ensures that prohibited waste forms are not present in the waste. The content code essentially gives a description of the TRU waste material in terms of processes and packaging, and the generation location. This helps to provide cradle-to-grave traceability of the waste material so that the various actions required to assess its qualification as payload for the TRUPACT-II package can be performed.

19340 **(DP-MS—88-162) Integrated waste management plan for the Savannah River Plant.** Cook, J.R.; Sturm, H.F. Jr.; Hoisington, J.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1989. Contract AC09-76SR00001. 10p. (CONF-890207—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007234/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

The Savannah River Plant will begin operation of several new waste disposal and treatment facilities during the next five year which will affect all waste streams generated on site. These will include a new solid low-level radioactive waste disposal facility, a hazardous/mixed waste disposal facility, and a low-level liquid waste solidification process. Existing waste sites will be closed in a technically and environmentally sound manner. Facility designs and closure plans are based on site-specific performance assessments and data from comprehensive monitoring systems. In addition, significant technical effort is directed toward waste volume reduction. These programs include compaction, incineration, waste avoidance, and clean waste segregation. These are elements of an integrated waste management plan that was developed to insure not only an effective, coordinated transition to these new facilities but to significantly enhance the overall site environmental management program. 3 refs.

19341 **(DPST—88-588-Rev.) A proposed algaculture facility at L Lake.** Wilde, E.W.; Benemann, J.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Georgia Inst. of Tech., Atlanta (USA). School of Applied Biology). 18 Nov 1988. Contract AC09-76SR00001. 109p. NTIS, PC A06/MF A01 - OSTI; GPO Dep. Order Number DE89007930/JAW.

The proposed project involves the development and establishment of an aquaculture system in L Lake, a 1000-acre cooling lake constructed at the Savannah River Plant (SRP) in 1985. Waste heat and excess nutrients would be used to produce valuable products derived from microalgae biomass. The process would simultaneously serve as an innovative mitigation scheme to help overcome the potential environmental problems associated with using L Lake to dissipate heat from the secondary cooling system for L Reactor. The project involves using the upper 300 acres of L Lake, the region most affected by thermal effluents, to cultivate (produce and harvest) microalgae, a process known commercially as "algaculture". Selected strains of nontoxic, thermotolerant, filamentous, nitrogen-fixing, blue-green algae would be used. These algae could be inoculated into the uppermost sections of L Lake, near the reactor outfall, and harvested at the lower boundary of the 300-acre project area with microstrainers. Part of the harvested biomass could be recycled back to the reactor outfall region to maintain a high density of the desired algal strain(s) within the project area.

19342 **(DPST—88-645) L-Lake primary producers: L Lake/Steel Creek Biological Monitoring Program, January 1986--December 1987.** Starkel, W.M.; Nagle, J.H.; Chimney, M.J. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 347p. (ECS-SR—61). NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007944/JAW.

The purpose of this portion of the L-Lake Biological Monitoring Program was to determine if effects of L-Reactor operation could be detected in the primary producer components of the different regions of L-Lake or in L-Lake when compared to other reservoirs in the area. The data in this report cover the period January 1986--December 1987. Little evidence could be found for a direct effect of the yearly cycle of reactor operation on the phytoplankton or periphyton of L-Lake. No direct effect of reactor operations upon the phytoplankton or periphyton of L-Lake could be inferred from differences among lake regions. The criteria for a "balanced biological community" may be addressed using data gathered on the phytoplankton and periphyton communities of L-Lake. The L-Lake phytoplankton was dominated by algae which are associated with nutrient enrichment, organic pollution, and other nuisance categories. About one-third of the dominant periphyton taxa in L-Lake are placed in nuisance categories.

19343 **(DPST—88-646) L-Lake habitat formers: L-Lake/Steel Creek Biological Monitoring Program, January 1986--December 1987.** Firth, P. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 100p. (ECS-SR—62). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007957/JAW.

The purpose of this study was to document the effects of L-Reactor operations on L-Lake habitat structure and shoreline plant community development from January 1986--December 1987. The near-shore regions of L-Lake were characterized by shallow, gently-sloping littoral zones. Aquatic plants colonized (and were planted in) the littoral zones of L-Lake in 1987, but areal coverage in the sampled plots were very low (< 2.5% cover). All of the

plant species mapped were emergent forms, and several of the plant taxa were obligate or facultative wetland species characteristic of southeastern lakes and wetlands. Potential animal habitat provided by solid substrates such as wood appeared to be sparse in all of the littoral areas mapped in L-Lake. Cover for fish was very poor in 1986 and only slightly better in 1987. The plant assemblage on the shoreline of L-Lake included more than 197 species representing 64 families. This assemblage was dominated by herbaceous species, particularly forbs. Diversity increased between 1986 and 1987. The peak above-ground living biomass occurred in summer at almost all lake sites. Above-ground standing crop was generally greater in Regions 4 and 5 than in Regions 6, 7, or 8.

19344 **(DPST—88-647) L-Lake zooplankton: L-Lake/ Steel Creek Biological Monitoring Program, January 1986--December 1987.** Chimney, M.J. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 115p. (ECS-SR—63). NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007931/JAW.

The objectives of this portion of the L-Lake Biological Monitoring Program are to provide an analysis of the zooplankton community in L-Lake that will help determine whether this ecosystem contains, or is developing in a manner that indicates that it will contain, a balanced biological community pursuant to the requirements for a successful 316(a) demonstration. The data presented in this report cover the period January 1986--December 1987. A total of 125 taxa were collected from the mixed zone of L-Lake in 1986 and 105 taxa from the mixed zone in 1987. Of the taxa identified, the microzooplankton accounted for 103 taxa (59 protozoans and 44 rotifers: 82.4% of all taxa) in 1986 and 88 taxa (53 protozoans and 35 rotifers: 83.8% of all taxa) in 1987. Taxa richness for each of the major taxonomic groups in the mixed zone ranged from 42 to 47 protozoans, 27 to 31 rotifers, eight to 11 cladocerans, seven to nine copepods, and one ostracod in each region in 1986 and 39 to 44 protozoans, 21 to 27 rotifers, seven to nine cladocerans, six to seven copepods and one ostracod in each region in 1987.

19345 **(DPST—88-648) L-Lake macroinvertebrates: L Lake/Steel Creek biological monitoring program: January 1986--December 1987.** O'Hop, J.R.; Lauritsen, D. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 189p. (ECS-SR—64). NTIS, PC A09/ MF A01 - OSTI; 1; GPO Dep. Order Number DE89007958/JAW.

The macroinvertebrate community in L-Lake was monitored from January 1986 to December 1987 to assess the biological development within this new cooling reservoir. Benthic macroinvertebrates are effective indicators of environmental stress because they are sedentary and relatively long-lived. Habitat quality may be reflected in the taxonomic composition, abundance, and total biomass of the macroinvertebrate community. Macroinvertebrate sampling included quantitative sampling of benthic habitats with a Ponar grab and qualitative sampling of nearshore habitats with dip nets. Emergence traps were used to collect adult insects emerging from the lake, where they had spent the larval stage of their life cycle. Invertebrate meroplankton was sampled at night by vertical tows of a 0.5 m diameter net. Densities of the predatory dipteran Chaoborus punctipennis, both in meroplankton and benthos, have increased markedly in the two year period following the creation of L-Lake. Densities in 1987 were comparable to those found in other southeastern reservoirs, including Par Pond.

19346 **(DPST—88-656) Steel Creek fish: L-Lake/Steel Creek Biological Monitoring Program, January 1986--December 1987.** Paller, M.H.; Heuer, J.H.; Kissick, L.A. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 162p. (ECS-SR—72). NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007945/JAW.

Fish samples were collected from Steel Creek during 1986 and 1987 following the impoundment of the headwaters of the stream to form L-Lake, a cooling reservoir for L-Reactor which began operating late in 1985. Electrofishing and ichthyoplankton sample stations were located throughout the creek. Fykenetting sample stations were located in the creek mouth and just above the Steel Creek swamp. Larval fish and fish eggs were collected with 0.5 m plankton nets. Multivariate analysis of the electrofishing data suggested that the fish assemblages in Steel Creek exhibited structural differences associated with proximity to L-Lake, and habitat gradients of current velocity, depth, and canopy cover. The Steel Creek corridor, a lotic reach beginning at the base of the L-Lake embankment was dominated by stream species and bluegill. The delta/swamp, formed where Steel Creek enters the Savannah River floodplain, was dominated by fishes characteristic of slow flowing waters and heavily vegetated habitats. The large channel draining the swamp supported many of the species found in the swamp plus riverine and anadromous forms.

19347 **(DPST—88-657) Steel Creek wildlife: L-Lake/ Steel Creek Biological Monitoring Program, January 1986--December 1987.** Giffin, M.A.; Patterson, K.K. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 89p. (ECS-SR—73). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007947/ JAW.

Reptile and amphibian populations in Steel Creek below L-Lake were assessed in monthly or quarterly sampling programs. Thirty-eight species of reptiles or amphibians were collected during 1987 in the Steel Creek corridor below the L-Lake impoundment, and in the delta and channel. Juvenile turtles and alligators, and larval amphibians were observed or collected during the study, indicating continued reproduction in Steel Creek. The reptile and amphibian populations in Steel Creek show no indication of any effect due to the impoundment of the lake or the operation of L-Reactor. Waterfowl and associated birds in Steel Creek below L-Lake were observed, in conjunction with other sampling programs, during winter--spring and fall--winter migrations. Nine species of waterfowl and five species of associated birds were observed in 1987 in the Steel Creek corridor below the L-Lake impoundment and in the delta and channel.

19348 **(DPST—88-952) Glass compositions and frit formulations developed for DWPF [Defense Waste Processing Facility].** Jantzen, C.M. (Savannah River Lab., Aiken, SC (USA)). 15 Nov 1988. Contract AC09-76SR00001. 60p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007956/JAW.

A family of glasses were developed for the Defense Waste Processing Facility (DWPF) coupled-feed operation (waste sludge plus precipitate hydrolysis aqueous product, PHA). These glass compositions have been formulated based on the following durability and processing criteria: the frit formulation should form glasses close in composition, and hence, close in durability and liquidus to sludge-only 165 waste glass, the frit formulation should never form glasses less durable than sludge-only 131 waste glass formulations, the frit formulation should form glasses intermediate in viscosity between 168 and 165 waste glasses but never exceed 100 poise (165 sludge-only glasses). Adjustment of frit formulations to accommodate the alkali and boron from PHA was found acceptable. The resulting frit designations and glass compositions are documented in this study. The experimental data for optimization of the durability, liquidus, and viscosity of these glasses as a function of glass composition will be reported elsewhere. Based on processing, fabrication, and durability considerations, Frit 202 (the most alkali depleted coupled frit formulation developed) has been recommended for initial DWPF operations. 27 refs., 10 tabs.

19349 **(DPST—88-1008) Summary of the precipitate hydrolysis task team peer review.** Jacobs, R.A. (Savannah River Lab., Aiken, SC (USA)). 5 Dec 1988. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007953/JAW.

On November 22, 1988, the activities of the Precipitate Hydrolysis Task Team (PHTT) were reviewed by an external peer review panel in the TNX Area Exhibit Room, 704-T. The agenda for the meeting and the meeting participants are attached. This memorandum serves as the minutes for the meeting, a summary of

the highlights of the review, and documentation of the follow up items.

19350 **(EPRI-EN—6231) The Underground Tank Risk Management (TANKS) Model: User's guide: Final report.** Cohan, D.; Hatcher, S.; Murk, L.; Selker, F.; Smith, A.E. (Electric Power Research Inst., Palo Alto, CA (USA); Decision Focus, Inc., Los Altos, CA (USA)). Feb 1989. 372p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes the capabilities and use of EPRI's Underground Tank Risk Management Model (TANKS). TANKS is a sophisticated software system designed to assist in the decisionmaking process regarding tank management strategies. TANKS can address important questions. What should be done with current tanks? What are the best leak detection and other management options for these tanks, and when should they be replaced? What types of tank systems should be installed when a new or replacement tank is needed: What leak detection is best for the selected system? What are the priorities for replacement and leak testing? What are the risks and costs of delaying action? How large are the savings associated with improvements in strategy? How much are risks reduced? Management options that can be assessed include: double-walled tanks and other forms of secondary containment, combinations of leak detection methods, aboveground tanks, tank repair or relining, testing of cathodic protection, and maximum tank age policies. 110 figs., 9 tabs.

19351 **(EPRI-NP—5674) Below Regulatory Concern Owners Group: Nonradiologic characterization and environmental assessment of BRC [Below-Regulatory Concern] waste: Final report.** Smith, C.F.; Vogt, D.K. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., Pleasanton, CA (USA)). Feb 1989. 64p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

EPRI is characterizing nonradiologic properties and assessing the environmental impact of candidate BRC waste types in support of a utility rulemaking petition. Recent investigations confirmed that these chemical and physical properties resembled those of conventional wastes and would not preclude disposal by conventional methods. In accordance with the NRC policy statement on below regulatory concern (BRC) waste, petitions to exempt certain wastes from low-level radioactive waste (LLRW) disposal regulations must include an assessment of the waste's nonradiologic properties. Petitions must also assure no significant environmental impact from BRC waste disposal, compatibility of the nonradiologic properties with the intended method of disposal, and negligible potential for recycling. This document characterizes the nonradiologic properties of candidate BRC waste types, as well as the properties of conventional waste and other materials associated with BRC waste disposal, and performs an environmental impact assessment of BRC waste disposal options.

19352 **(EPRI-NP—6244) Evaluation of hydrogen diffusion from low-level radioactive waste containers: Final report.** Smith, C.F.; Phillips, L.B. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., Pleasanton, CA (USA)). Feb 1989. 76p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89007932/JAW.

This report provides a summary of work accomplished to date in the area of hydrogen generation and diffusion. It also identifies potential future applications of hydrogen diffusion testing which may be of significant benefit to the nuclear industry. The work described in this report includes a survey of utility radwaste engineers, burial site operators, and high integrity container manufacturers as well as a summary of bibliographical data from a large number of available sources. Preliminary laboratory tests and modeling studies are also described. These efforts were performed in support of possible future hydrogen diffusion studies designed to enable efficient performance evaluation of vent hardware functioning to provide a diffusion path for the release of hydrogen. 24 refs., 1 fig., 1 tab.

19353 **(EUR—11030) Solidification of alpha-bearing wastes in a ceramic matrix.** Loida, A.; Schubert, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (DE). Inst. fuer Nukleare Entsorgungstechnik). (Commission of the European Communities, Luxembourg). 1988. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number TI88757002/JAW.

The aim of this work was to complete the experimental demonstration on the feasibility of incorporating original TRU-waste in a ceramic matrix as well as the prosecution of the evaluation of a technical process producing TRU-waste bearing ceramic pellets. The following kinds of original TRU-waste had been incorporated in ceramics: dissolver residues from the reprocessing of fast breeder reactor fuel elements (KNK II at KfK), residues from the acid digestion of burnable TRU-wastes produced in the ALONA-facility/ Mol, Belgium, TRU-element bearing sludges, precipitated from original MAW-solutions, according to the waste splitting method. The final products were characterized by determinating their density, open porosity, mechanical strength, homogeneity, phase composition, microstructure as well as leacheability. No deterioration with regard to the product-properties required for the final disposal of radioactive waste could be detected by investigating these TRU-waste ceramic pellets. According to the requirements of a technical process it was necessary to find out the dependence of the product quality from producing parameters. Therefore the most convenient composition of the matrix raw material had been determined with 66 wt% reactive corundum, 17 wt% kaolinite, 17 wt% bentonite.

19354 **(EUR—11551) Separation of tritium from aqueous effluents.** Geens, L.; Bruggeman, A.; Meynendonckx, L.; Parmentier, C.; Belien, H.; Ooms, E.; Smets, D.; Stevens, J.; van Vlerken, J. (Centre d'Etude de l'Energie Nucleaire, Mol (BE)). (Commission of the European Communities, Luxembourg). 1988. 54p. NTIS (US Sales Only), PC A04/ MF A01. Order Number TI88756985/JAW.

From 1975 until 1982 - within the framework of the CEC indirect action programme on management and storage of radioactive waste - the SCK/CEN has developed the ELEX process from laboratory scale experiments up to the construction of an integrated pilot installation. The ELEX process combines water electrolysis and catalytical isotope exchange for the separation of tritium from aqueous reprocessing effluents by isotope enrichment. Consequently, the pilot installation consists of two main parts: an 80 kW water electrolyser and a 10 cm diameter trickle bed exchange column. The feed rate of tritiated water amounts to 5 dm/sup 3/.h/sup -1/, containing up to 3.7 GBq.dm/sup -3/ of tritium. This report describes the further development of the process during the second phase of the second programme. Three main items are reported: (i) research work in the field of pretreatment of real reprocessing effluents, before feeding them to an ELEX installation; (ii) demonstration of the technical feasibility of the ELEX process with simulated active effluent streams in the pilot installation; (iii) a cost estimation for the ELEX installation, comprising the required investments and the annual operation costs.

19355 **(FMPC—2082-Add.) History of FMPC [Feed Materials Production Center] radionuclide discharges: Revised estimates of uranium and throium air emissions from 1951--1987.** Clark, T.R.; Elikan, L.; Hill, C.A.; Speicher, B.L. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). Mar 1989. Contract AC05-86OR21600. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007969/JAW.

This study results in estimated uranium air emissions of 179,000 kg and an estimated thorium air emission of 6500 kg for the years of 1951 through 1987. These revised estimates are conservative and differ from the estimate reported in FMPC-2082 by the addition of emissions from uranium trioxide gulping (Plant 2/3); other unmonitored processes; building exhausts; laboratory vents; non-routine events; fugitive emissions from waste pits, and additional years of thorium processing from which emissions had not previously been reported. An annual summary of these emissions is included. The uranium estimate shows the value reported with the additional uranium emissions listed by category. The thorium estimate is a revised estimate that is to be used. The relationship be-

tween the previous yearly estimates and the new revised estimates for uranium are demonstrated, as is the distribution of the thorium emissions by year. 12 refs., 1 fig., 4 tabs.

19356 **(GSF—18/88) Radiation protection and environmental monitoring in the area of the Asse shaft plant. Annual report 1987.** Mueller-Lyda, I.; Meyer, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.); Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). Jul 1988. 42p. (In German). NTIS (US Sales Only), PC A03/ MF A01. Order Number DE88756937/JAW.

Personnel monitoring has been carried through in compliance with the Radiation Protection Ordinance. Environmental monitoring including measurement of local doses, local dose rates, and airborne radioactivity in the shaft has been made according to the provisions for radiation protection at the place of work. Maximum permissible personal doses or activity levels for occupationally exposed persons have not been exceeded in the reporting period. Exhaust air monitoring detected the nuclides H-3, C-14, Pb-210, and the short-lived daughter products of Rn-222 and Rn-220. The activity concentrations in the environment, determined from the measured annual release values, for some part have been lower than the average of natural concentrations of said nuclides. The radiation exposure due to emissions, measured at the least favourable point in the environment, has been far below the limits set by the Radiation Protection Ordinance. In conclusion: The radiation exposure of the personnel and of the population in the area of the Asse shaft plant due to the storage of radioactive is low, compared to the natural radiation exposure.

19357 **(INFO—0229) Shallow ground disposal - calculation of dose.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); INTERA Technologies, Ottawa, ON (Canada)). Feb 1987. 145p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705506/ JAW.

In FORTRAN IV on HP 100 computer.

The ability of an existing shallow land burial systems model to meet AECB user requirements has been evaluated. The deficiencies of the program are identified and activities necessary to modify the code to fulfill the user requirements are outlined. Implementation plans for a number of likely scenarios have been constructed and possible cost-cutting measures have been recommended.

19358 (INIS-BR—1411, pp 124-138) **Radioactive waste management of the radiological accident in Goianaia, Brazil - Cooperation of Waste Treatment Division.** Guzella, M.F.R.; Miaw, S.T.W.; Reis, L.C.S.; Santos, P.O.; Silva, E.M.P.; Tello, C.C.O. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Radioactive waste were generated in Goiania by an accidental breakage of Cesium 137 radiotherapie source (A=5,0 x 10/sup 13/ Bq) in September 1987. The Waste Treatment Division (DITRR.CN) CDTN/NUCLEBRAS has worked in all critical areas to remove the contamination and carried out the tasks at the interim storage. Experience on the waste management and the results from the R and D works conducted by the Division were applied. The R and D works conducted by the Division were applied. The R and D works conducted by the Division were applied. The R and D works comprise package for storage and transport of radioactive material, the use of selected bentonite for Cesium 137 retention, installation of waste treatment facilities and elaboration of several specific procedures.

19359 (INIS-BR—1411, pp 305-313) **Radiological protection procedures and decisions at Setor Norte Ferroviario of Goiania city in its emergence condition.** Silva, J.J.G. (Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

A description of the procedures and decisions adopted at Setor Norte Ferroviario of Goiania City in its emergence condition due to the radiological accident there happened, are presented. The main objectives of the adoption of the described procedures were to avoid high radiation doses for the personnal envolved with the works performed at the site and the dispersion of the contamination to other areas. Some considerations are made with respect to radwastes, its conditioning and transport to storage.

19360 (INIS-BR—1411, pp 285-294) **Management of radioactive wastes from HNMD (Hospital Naval Marcilio Dias) and from IRD (Instituto de Radioprotecao e Dosimetria) due to the accident in Goiania.** Peres, S.S.; Silva, J.J.G. (Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

A description of the methods and procedures for the management of the radwastes from HNMD (Hospital Naval Marcilio Dias) and from IRD (Instituto de Radioprotecao e Dosimetria) due to the radioactive accident at Goiania City, is presented. Basically the radwastes are consituted by excreta of persons involved in the accident and materials used for medicals care of patients. The method employed for treatment of faeces was its aggregation in lime and cement and for the case of urine, ion exchange resing, was used. Others type of radwastes were compacted or simply conditionned. Many releases to the environment, were possible.

19361 (INIS-BR—1411, pp 186-190) **Concept of waste storage in a former iron mine.** Kirchhoff, K. (Lower Saxony State Office for Immission Protection Hannover (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

In Federal Republic of Germany it is planned to store the radioactive waste material in old mines. Low and medium activity waste material without significant heat production will be stored in an old iron mine named Konrad, situated in the northern part of Germany. According to the time schedule work will be started in 1993/94. The concept waste conditioning and storage will be discussed.

19362 **(INIS-mf—11394) Sediments, fauna, and the dispersal of radionuclides at the N.E. Atlantic dumpsite for low-level radioactive waste. Report of the Dutch DORA program.** Rutgers van der Loeff, M.M.; Lavaleye, M.S.S. (Netherlands Inst. for Sea Research, Den Burg). 1986. 134p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706089/JAW.

The seafloor at the NEA dumpsite for low-level radioactive waste has been investigated by geochemical and biological techniques. Evidence of local turbidities and slumping is recorded in the sediment, probably related to the steep local topography. Slumping events could be triggered by dumping operations. The CaCO/sub 3/ content is the principle variable that accounts for most of the variation in the elemental composition and cation exchange capacity of the sediment. Diagenetic modeling is used to explain the interrelationships between: (1) mineralization of organic material and (2) redox transitions, (3) cation exchange, and (4) carbonate dissolution and recrystallization. These diagenetic processes are discussed in terms of their effects on the redistribution and transport of trace elements and radionuclides within the sediment and between sediment and overlying water. Composition, density, biomass, vertical and horizontal distribution has been studied of benthic meio- as well as macrofauna of the NEA-dumpsite. The

processes that have been shown to influence the fate of radionuclides that are released from the waste packages are: transport from bottom water to sediment; transport within the sediment; and transformation of radionuclides within the sediment. 194 refs.; 58 figs.; 40 tabs.

19363 **(KAERI/RR—689/87) Construction of solid waste form test and inspection facility.** Park, Hun Hwee; Lee, Kang Moo; Jung, In Ha; Kim, Sung Hwan; Yoo, Jeong Woo; Lee, Jong Youl; Bae, Sang Min. (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). Jan 1988. 118p. (In Korean). NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706100/JAW.

The solid waste form test and inspection facility is a facility to test and inspect the characteristics of waste forms, such as homogenity, mechanical structure, thermal behaviour, water resistance and leachability. Such kinds of characteristics in waste forms are required to meet a certain conditions for long-term storage or for final disposal of wastes. The facility will be used to evaluate safety for the disposal of wastes by test and inspection. At this moment, the efforts to search the most effective management of the radioactive wastes generated from power plants and radioisotope user are being executed by the people related to this field. Therefore, the facility becomes more significant tool because of its guidance of sucessfully converting wastes into forms to give a credit to the safety of waste disposal for managing the radioactive wastes. In addition the overall technical standards for inspecting of waste forms such as the standardized equipment and processes in the facility will be estabilished in the begining of 1990's when the project of waste management will be on the stream. Some of the items of the project have been standardized for the purpose of localization. In future, this facility will be utilized not only for the inspection of waste forms but also for the periodic decontamination apparatus by remote operation techniques.

19364 **(KAERI/RR—699/86) Techniques for the evaluation of radioactive waste forms.** Park, Hun Hwee; Kim, Joon Hyung; Kim, Hwan Young; Seo, Yong Chil; Jung, Ki Jung; Kim, Jeong Guk; Kim, In Tae; Kim, Ki Hong; Yang, Hee Chul; Lee, Kune Woo and others. (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). May 1987. 485p. (In Korean). NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS. Order Number DE88706102/JAW.

Before disposal of the radioactive waste packages, waste forms must meet some requirements to facilitate handling and to provide protection and safety of personnel during transportation, storage and disposal. And they must have the structural stability until the end of the cooling period on radioactivity in disposal site. Evaluation and characterization of waste forms are very important tools to check out satisfaction for such requirements and to analyze environmental effects of them. First of all, the waste classifications in foreign countries based on disposal were considered to develope the techniques for evaluating radioactive waste forms. And the requirements were grouped two and discussed. 'handling stability requirements' that all waste forms should have for facilitating handling and providing protection and safety of personnel during all steps in management, and 'storage and disposal stability requirements' that they should meet as long as protentially harmful levels of radioactivity exist in repository. Next, the test items were selected based on characteristics of the actual waste form. The selected test methods were standardized with Korea Standard(KS), and in case of other items which has not shown is KS, the generally known foreign test methods for radioactive waste forms were chosen. The description of test methods refered to 'Manual for evaluation of plastic waste forms (1984)' published by 'Study group on manual for evaluation of plastic waste forms'in Japan. From above test methods, The test items applied to solidification technique and/or disposal and evaluation methods to be necessary in development of solidification matrix and processes were suggested.

19365 **(KFK—4506) Sintered glass.** Gahlert, S.; Ondracek, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung 1 - Teilinstitut Kernbrennstoffe). Jan 1989. 34p. Special print from: Lutze, W.; Ewing, R.C. (eds.): Radioactive waste forms for the future, Elsevier, Netherlands, 1988 p. 161-192.

Hot-pressed glass is a waste form suitable for the immobilization of high-level waste from the reprocessing of light water reactor and fast breeder fuel. The basic process has been investigated and optimized. The technology has been demonstrated with inactive HLW simulates; products up to diameters of 30 cm were highly dense (≧ 95% TD) and macroscopically homogeneous. When compared to glass melting, vitrification by powder technology leads to an important reduction in processing temperatures (≃ 500 K). The temperature reduction and the absence of the liquid state offers some major advantages: - The production of secondary waste by evaporation losses is reduced considerably. - Segregations and macroscopic inhomogeneities, as well as melter corrosion problems are excluded. - Variations of waste composition and waste loading affect processing conditions and product performance only to a minor extent; waste loadings up to 35 wt% were demonstrated. In addition, the process is simplified by the use of containers that can be easily arranged and stacked to any chosen height. Although in general physical and mechanical properties of molten and sintered glasses are comparable, chemical durability of hot-pressed glass products is markedly enhanced by the utilization of more durable glasses (e.g. higher silicon and aluminum and lower sodium content).

19366 **(LA—10667-MS) Evaluation of past and future alterations in tuff at Yucca Mountain, Nevada, based on the clay mineralogy of drill cores USW G-1, G-2, and G-3.** Bish, D.L. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008317/JAW.

The tuffs at Yucca Mountain in south-central Nevada are being studied by the Yucca Mountain Project (YMP) to determine their suitability for a high-level radioactive waste repository. For predictive purposes, it is important to understand the alteration history of Yucca Mountain and to know how the minerals in Yucca Mountain tuffs respond to changing conditions such as elevated temperatures. The clay mineralogy of these tuffs has been examined using x-ray powder diffraction, and approximation temperatures of alteration have been determined using available clay mineral data and fluid inclusion analyses. Also, several illites from drill holes USW G-1 and G-2 have been dated using K/Ar techniques, yielding ages of about 11 Myr. The clay mineral in Yucca Mountain tuffs are predominantly interstratified illite/smectites, with minor amounts of chloride, kaolinite, and interstratified chlorite/smectite at depth in USW G-1 and G-2. The reactions observed for these illite/smectites are similar to those observed in pelitic rocks. With depths, the illite/smectites transform from random interstratifications (R = 0) through ordered intermediates (R = 1) to illite in USW G-2 and to Kalkberg (R ≧ 3) interstratifications in USW G-1. The illite/smectites in USW G-3 have not significantly transformed. It appears that the illites in deeper rock results from hydrothermal and diagenetic reactions of earlier-formed smectites. These data demonstrate that the rocks at depth in the northern end of Yucca Mountain were significantly altered about 11 Myr ago. Both clay mineralogy and fluid inclusions suggest that the rocks at depth in USW G-2 have been subjected to postdepositional temperatures of at least 275{degree}C, those in USW G-1 have reached 200{degree}C, and USW G-3 rocks probably have not exceeded 100{degree}C. 64 refs., 9 figs., 3 tabs.

19367 **(LA—11459-MS) An analysis of precipitation occurrences in Los Alamos, New Mexico, for long-term predictions of waste repository behavior.** Nyhan, J.; Beckman, R.; Bowen, B. (Los Alamos National Lab., NM (USA)). Feb 1989. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008832/JAW.

This study describes precipitation as an uncontrolled natural input influencing the hydrology of waste repositories in terms of

their ultimate long-term closure. The general climatology of the western states, including that of New Mexico and Los Alamos, is first described. An analysis of the precipitation patterns at Los Alamos is then presented to be used for predicting long-term precipitation occurrences and shallow land burial site behavior. The waste management implications of this precipitation analysis are then discussed and future meteorological research needs are identified. 13 refs., 10 figs., 2 tabs.

19368 **(LA-UR—88-4155) Preliminary geologic map of the Lathrop Wells volcanic center.** Crowe, B.; Harrington, C.; McFadden, L.; Perry, F.; Wells, S.; Turrin, B.; Champion, D. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008185/JAW.

A preliminary geologic map has been compiled for the bedrock geology of the Lathrop Wells volcanic center. The map was completed through use of a combination of stereo photographic interpretation and field mapping on color aerial photographs. These photographs (scale 1:4000) were obtained from American Aerial Surveys, Inc. They were flown on August 18, 1987, at the request of the Yucca Mountain Project (then Nevada Nuclear Waste Storage Investigations). The photographs are the Lathrop Wells VC-Area 25 series, numbers 1--32. The original negatives for these photographs are on file with American Aerial Surveys, Inc. Copies of the negatives have been archived at the Los Alamos National Laboratory, Group N-5. The preliminary geologic map is a bedrock geologic map. It does not show alluvial deposits, eolian sands, or scoria fall deposits from the youngest eruptive events. The units will be compiled on separate maps when the geomorphic and soils studies are more advanced.

19369 **(LA-UR—89-643) Establishing a regulatory framework for a RCRA [Resource, Conservation, and Recovery Act] corrective action program.** Krueger, J.W. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 13p. (CONF-890207—12). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008021/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

Recently, the environmental community has become keenly aware of problems associated with integration of the demanding regulations that apply to environmental restoration activities. One can not attend an EPA-sponsored conference on Superfund without distracting questions concerning the Resource, Conservation, and Recovery Act (RCRA) and the applicability of the National Contingency Plan (NCP) to sites that do not qualify for the National Priorities List (NPL). In particular, the US Department of Energy (DOE) has been greatly criticized for its inability to define a comprehensive approach for cleaning up its hazardous waste sites. This article presents two decision flowcharts designed to resolve some of this confusion for DOE. The RCRA/CERCLA Integration Diagram can help the environmental manager determine which law applies and under what conditions, and the RCRA Corrective Action Decision Flowchart can guide the manager in determining which specific sections of RCRA apply to a RCRA-lead environmental restoration program. 13 refs.

19370 **(LBL—26058) Theory and calculation of water distribution in bentonite in a thermal field.** Carnahan, C.L. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 10p. (CONF-881066—5). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007131/JAW.

From 12. international symposium on the scientific basis for nuclear waste management; Berlin, F.R. Germany (10 Oct 1988).

Highly compacted bentonite is under consideration for use as a buffer material in geological repositories for high-level radioactive wastes. To assess the suitability of bentonite for this use, it is necessary to be able to predict the rate and spatial extent of water uptake and water distribution in highly compacted bentonite in the presence of thermal gradients. The "Buffer Mass Test" (BMT) was conducted by workers in Sweden as part of the Stripa Project. The BMT measured uptake and spatial distributions of water infiltrating annuli of compacted MX-80 sodium bentonite heated from within and surrounded by granite rock; the measurements provided a body of data very valuable for comparison to results of theoretical calculations. Results of experiments on adsorption of water by highly compacted MX-80 bentonite have been reported by workers in Switzerland. The experiments included measurements of heats of immersion and adsorption-desorption isotherms. These measurements provide the basis for prediction of water vapor pressures in equilibrium with bentonite having specified adsorbed water contents at various temperatures. The present work offers a phenomenological description of the processes influencing movement of water in compacted bentonite in the presence of a variable thermal field. The theory is applied to the bentonite buffer-water system in an assumed steady state of heat and mass transport, using critical data derived from the experimental work done in Switzerland. Results of the theory are compared to distributions of absorbed water in buffers observed in the Swedish BMT experiments. 9 refs., 2 figs.

19371 **(NAGRA-NTB—88-25) Sediment study - Interim report 1988. Possibilities for final disposal of long-lived radioactive wastes in the sediments of Switzerland. Text volume.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Oct 1988. 488p. (In German). Nagra, CH-5401 Baden, Switzerland.

In the current Swiss nuclear waste disposal concept, vitrified high-level wastes (HLW) and some long-lived intermediate-level wastes will be included in a deep geological Type C repository. The project Gewaehr 1985 study demonstrated, in principle, the safety of such a repository situated in the granitic bedrock of Northern Switzerland. An ongoing geologic investigation programme is aimed at locating potential repository siting regions. In parallel to the crystalline programme, Nagra is also investigating the potential of sedimentary formations to host such a Type C repository. The consideration of this option has also been recommended by the Swiss Regulatory Authorities in their review of Project Gewaehr 1985. Furthermore, the authorities have recommended that such vertically accessed sediments should also be considered for a wider range of intermediate-level waste sorts which have been previously allocated to a horizontally accessed Type B repository. This intermediate report documents the first stage of investigation of deep sediments aimed at fulfilling both the above objectives. 6 potential Opalinus-Ton regions and 2 Untere Suesswassermolasse (USM) siting regions were examined in more detail, with particular reference to tectonic conditions and suitable formation depth. From these, 2 potential siting regions for Opalinus-Ton ('Zuercher Weinland' and 'Region noerdlich der Laegeren') and one for USM ('Region oestlich der Limmat') were selected for further studies. An outline of the programme of work required to further reduce these to a single first priority sediment site is also presented. In the next phase of the study, increased attention will be devoted to studying exploration strategies in the 2 sediments with the aim of quantifying the effort needed for an appropriate level of geologic characterisation for more detailed development of disposal projects. 641 refs., 147 figs., 70 tabs.

19372 **(NAGRA-NTB—88-25) Sediment study - Interim report 1988. Possibilities for final disposal of long-lived radioactive wastes in the sediments of Switzerland. Supplement volume.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Oct 1988. 39p. (In German). Nagra, CH-5401 Baden, Switzerland.

In the current Swiss nuclear waste disposal concept, vitrified high-level wastes (HLW) and some long-lived intermediate-level wastes will be included in a deep geological Type C repository. The project Gewaehr 1985 study demonstrated, in principle, the safety of such a repository situated in the granitic bedrock of Northern Switzerland. An ongoing geologic investigation programme is aimed at locating potential repository siting regions. In parallel to the crystalline programme, Nagra is also investigating the potential of sedimentary formations to host such a Type C repository. The consideration of this option has also been recommended by the Swiss Regulatory Authorities in their review of Project Gewaehr 1985. Furthermore, the authorities have recommended that such vertically accessed sediments should also be considered for a wider range of intermediate-level waste sorts which have been previously allocated to a horizontally accessed Type B repository. This intermediate report documents the first stage of investigation of deep sediments aimed at fulfilling both the above ob-

jectives. 6 potential Opalinus-Ton regions and 2 Untere Suesswassermolasse (USM) siting regions were examined in more detail, with particular reference to tectonic conditions and suitable formation depth. From these, 2 potential siting regions for Opalinus-Ton ('Zuercher Weinland' and 'Region noerdlich der Laegeren') and one for USM ('Region oestlich der Limmat') were selected for further studies. An outline of the programme of work required to further reduce these to a single first priority sediment site is also presented. In the next phase of the study, increased attention will be devoted to studying exploration strategies in the 2 sediments with the aim of quantifying the effort needed for an appropriate level of geologic characterisation for more detailed development of disposal projects. 36 figs.

19373 **(NAGRA-NTB—88-29) Migration chemistry and behaviour of iodine relevant to geological disposal of radioactive wastes - a literature review with a compilation of sorption data.** Yuanfang, Liu; Gunten, H.R. von. (Paul Scherrer Institut, Wuerenlingen (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Sep 1988. 183p. Nagra, CH-5401 Baden, Switzerland.

This report reviews the literature on iodine migration, chemistry and behaviour in the environment up to November 1987. It deals mainly with /sup 129/I released from a land repository, with particular consideration of the Swiss scenario for the disposal of low- and medium-level radioactive waste. As a background to this review, the basic properties of radioiodine, its distribution, circulation in nature and radiological impact are presented. A large number of sorption and diffusion data for iodine on rocks, sediments, minerals, cements and other materials have been compiled from many different laboratories. Based on this information, an assessment of the sorption and retardation of radioiodine in geomedia is made and methodologies for obtaining sorption distribution ratios (R/sub D/ values) are discussed. The review also covers natural analogue studies of /sup 129/I, retardation of iodine by cement barriers and the possible influences of organic compounds and microorganisms on the behaviour of iodine. Some possibilities for further research on diffusion measurements and near-field chemistry of radioiodine are outlined. (author) 259 refs., 9 figs., 30 tabs.

19374 **(NSS/G—102) Engineered barriers: current status.** Atkinson, A.; Marsh, G.P. (UKAEA Harwell Lab. Materials Development Div.). (United Kingdom Nirex, Ltd., Harwell). Jan 1988. 65p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705579/JAW.

This report summarises the current state of research relevant to assessing the performance of engineered barriers made of steel and concrete in radioactive waste repositories. The objective of these barriers is to contain the radionuclides within them by providing both physical and chemical impediment to their release. The physical barriers are of most value for highly soluble isotopes with relatively short half-lives (eg /sup 137/Cs), since they can provide containment until a large fraction of the activity has decayed. In addition they can facilitate retrievability for some period after disposal. The chemical barriers operate by beneficial conditioning of the near field groundwater and providing sites for sorption of radionuclides. Both of these reduce the aqueous concentration of radionuclides in the near field.

19375 **(NSS/R—115) Extensions to the coupled chemical equilibria and migration code CHEQMATE.** Haworth, A.; Sharland, S.M.; Tasker, P.W.; Tweed, C.J. (UKAEA Harwell Lab. Theoretical Physics Div.). (United Kingdom Nirex, Ltd., Harwell). Aug 1988. 21p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706117/JAW.

The CHEQMATE program was developed to model the evolution of spatially inhomogeneous aqueous chemical systems. The original CHEQMATE models one-dimensional diffusion and electromigration of ionic species with chemical equilibration provided by the geochemical program PHREEQE. CHEQMATE has principally been used to study the evolution of the chemical environment in and around a nuclear waste repository. In this paper, we describe extensions to CHEQMATE to increase the range of situations that can be modelled. These extensions are the addition of advection of species in a constant groundwater flow, the facility to model migration of species through a series of media with different transport properties and migration in a spherical geometry which allows investigation of dilution effects. For each extension, we describe the alterations in the transport part of the code and consider how the model is set up. An example of a problem using the different versions is given.

19376 **(NSS/R—122) Solubility and sorption of protactinium in the near-field and far-field environments of a radioactive waste repository.** Berry, J.A.; Hobley, J.; Lane, S.A.; Littleboy, A.K.; Nash, M.J.; Oliver, P.; Smith-Briggs, J.L.; Williams, S.J. (UKAEA Harwell Lab. Chemistry Div.). (United Kingdom Nirex, Ltd., Harwell). Oct 1988. 31p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706118/JAW.

The solubility and sorption of protactinium have been studied for typical near-field and far-field chemical environments. The apparent solubility limit of protactinium in the near-field at pH 11 to pH 12 is about 10/sup -10/M. Sorption onto all of the solid phases studied is typically high, with values of R/sub D/ ranging from 10/sup 2/ to 10/sup 6/ ml g/sup -1/. These values of R/sub D/ vary with the hase separation technique used, the initial concentration of protactinium and the water to rock ratio employed. This variation in R/sub D/ is in part attributable to the formation of large polymeric (or agglomerated) species under all the experimental conditions considered.

19377 **(NSS/R—125) Mass transfer in water-saturated concretes.** Harris, A.W.; Atkinson, A.; Nickerson, A.K.; Everitt, N.M. (UKAEA Harwell Lab. Materials Development Div.). (United Kingdom Nirex, Ltd., Harwell). Jul 1988. 36p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706119/JAW.

The performance of cementitious material as a mainly physical barrier to the escape of dissolved radionuclide species from a repository depends on the mass-transfer characteristics of the chosen material. In particular the diffusion and sorption behaviour and the water permeability are important. These parameters have been measured for a variety of cementitious materials; all possible repository construction materials. Measurements have been made using aqueous iodide, strontium and caesium ions and tritiated water as the diffusant species. The results show that the diffusion of tritiated water is more rapid than that of the other species whilst the transport of strontium and caesium is hindered by significant sorption, particularly in materials containing blast furnace slag.

19378 **(ORNL/TM—11055) High precision isotopic ratio measurements krypton and xenon: Final report.** Smith, D.H.; McBay, E.H.; Mueller, T.R.; Walker, R.L.; Carter, J.A. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007852/JAW.

A study has been concluded that investigated the ability of a modern commercial mass spectrometer to provide high precision isotope ratio measurements of krypton and xenon. A VG-354 (VG Isotopes, Winsford, UK) was modified to analyze gases. Precisions of 5 ppM relative standard error of the mean or better were obtained for isotopes of 10% abundance or greater. This successful demonstration means that it will be possible to acquire an instrument with this capability with high confidence that the stringent demands on precision will be met or exceeded. 4 tabs.

19379 **(PNL—6790) Processing summary report: Fabrication of cesium and strontium heat and radiation sources.** Holton, L.K. Jr.; Surma, J.A.; Allen, R.P.; Brouns, R.A.; Bryan, G.H.; Elliott, M.L.; Goles, R.W.; Haun, F.E.; Klein, R.F.; Peters, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 90p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008314/JAW.

The Pacific Northwest Laboratory (PNL), has produced 30 isotopic heat sources (canisters) for the Federal Republic of Germany (FRG) to be used as part of a repository testing program in the Asse Salt Mine. PNL program work involved the filling, closure,

and decontamination of the 30 canisters. The canisters were fabricated (filled) in three separate processing campaigns using the radioactive liquid-fed ceramic melter to produce a borosilicate glass. Within the borosilicate glass matrix radiochemical constituents (^{137}Cs and ^{90}Sr) were immobilized to yield a product with a predetermined decay heat and surface radiation exposure rate.

19380 **(PNL—6800-Pt.5) Pacific Northwest Laboratory annual report for 1988 to the Assistant Secretary for Environment, Safety, and Health: Part 5, Environment, safety, health, and quality assurance.** Faust, L.G.; Pennell, W.T.; Selby, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008315/JAW.

This document summarizes the research programs now underway at Battelle's Pacific Northwest Laboratory in the areas of environmental safety, health, and quality assurance. Topics include internal irradiation, emergency plans, dose equivalents, risk assessment, dose equivalents, surveys, neutron dosimetry, and radiation accidents. (TEM)

19381 **(PNL-SA—15958) Characterization of contaminants in the subsurface of the Hanford Site.** Evans, J.C.; Murphy, E. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 34p. (CONF-8806159—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008126/JAW.

From In situ characterization and monitoring technologies; Idaho Falls, ID, USA (7 Jun 1988).

An extensive chemical monitoring program for compliance with RCRA regulations began at specific sites in mid-1985. Some site-wide chemical monitoring was also initiated in late 1985 and early 1986. A much more ambitious site-wide chemical monitoring program was initiated in early 1987. Preliminary assessment/site inspection (PA/SI) work was performed in 1986--1987 for compliance with CERCLA/SARA. That work identified sources of radiological and chemical contaminants at 646 inactive waste sites, estimated approximate subsurface inventories, and provided relative site hazard rankings. The US Environmental Protection Agency (EPA) announced intention to include Hanford on the National Priority Listing (NPL) in 1988; however, the status of that listing is currently in question because of jurisdictional questions involving the US Department of Energy, EPA, and the State of Washington. Pending resolution of that dispute, remedial investigations will begin. The attached maps show the four NPL Aggregate Areas and 23 NPL Waste Area Groups containing over 1450 individual waste sites. Operational unit designations will be completed in July 1988. The final number of operational units requiring remedial investigations is expected to be about 80.

19382 **(PNL-SA—16140) Comparability between NQA-1 and the QA programs for analytical laboratories within the nuclear industry and EPA hazardous waste laboratories.** English, S.L.; Dahl, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 11p. (CONF-890207—9). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008128/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

As a multi-faceted research and development organization, PNL has continually pioneered the application of NQA-1 to activities for which it was not originally designed. If you can look beyond the technical terminology and focus on the concepts behind each basic requirement, then you discover many of the same QA concerns in the ASTM, EPA, and NQA-1 programs. At PNL, the implementation of elements of the varied QA programs of ASTM, EPA and NQA-1 has produced an almost symbiotic relationship. Each QA program serves to supplement the gaps or weaknesses of the others. The basic requirements of NQA-1 supplemented with quality control and data quality considerations have been a sound basis for the analytical laboratory QA program at PNL.

19383 **(PNL-SA—16658) Fabrication of vitrified isotopic heat and radiation sources for testing in the Asse Mine.** Holton, L.K.; Burkholder, H.C.; McElroy, J.L.; Kahl, L.; Kroebel, R.; Rothfuchs, T.; Strippler, R. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 25p. (CONF-890207—10). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008129/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

The Pacific Northwest Laboratory (PNL), under contract to the US Department of Energy, has produced 30 isotopic heat and radiation sources (canisters) for the Federal Republic of Germany (FRG) to be used as part of a repository testing program in the Asse Salt Mine. PNL was responsible for the fabrication, including filling, closing, decontaminating, and characterizing the canisters. The canisters were fabricated (filled) in three separate processing campaigns using the radioactive liquid-fed ceramic melter to produce a borosilicate glass. Radiochemical constituents (^{137}Cs and ^{90}Sr) were immobilized within the borosilicate glass matrix to yield a product with a predetermined decay heat and surface radiation exposure rate. Canister lid-welding was completed using an autogenous gas tungsten arc welding process. A helium leak test of lid weld tightness verified the leak rate to be no greater than 2.4 {times} 10/sup {minus}8/ atm-cc/sec, which was less than the criterion of 10/sup {minus}7/ atm-cc/sec. The top, sides, and bottom of the canisters were decontaminated by electropolishing. All canisters were decontaminated to surface smear contamination levels of less than 33 Bq/100 cm^2 beta-gamma radiation. No significant alpha contamination was observed on canister surfaces. 11 figs., 2 tabs.

19384 **(RFP—4288) Modeling of shallow high-resolution reflection seismic method at a hazardous waste site.** Irons, L.A.; Lewis, B. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1989. Contract AC04-76DP03533. 39p. (CONF-890320—1). NTIS, PC A03 - OSTI. Order Number DE89008117/JAW.

From 2. annual symposium on the application of geophysics to engineering and environmental problems; Golden, CO, USA (13 Mar 1989).

The use of the shallow high-resolution reflection seismic method for mapping Arapahoe Formation sandstone lenses in the near subsurface at the Rocky Flats Plant near Golden, Colorado, was evaluated using seismic modeling. The modeling helped to determine the feasibility of using the shallow seismic reflection common depth point (CDP) method and to identify potential data acquisition and processing problems. Estimates of vertical and horizontal resolutions were also determined by analyzing the modeling results. The field acquisition parameters for the CDP method were selected after analysis of the synthetic displays. The seismic modeling provided a cost effective method to evaluate the feasibility of the shallow reflection method before performing field tests. 7 refs., 1 fig., 1 tab.

19385 **(SAND—87-0138) Stable-isotope geochemistry of groundwaters in the Delaware Basin of southeastern New Mexico.** Lambert, S.J.; Harvey, D.M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1987. Contract AC04-76DP00789. 256p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008316/JAW.

$^{18}O/^{16}O$ and D/H ratio measurements have been made on groundwaters sampled from the Rustler Formation (Ochoan, Permian) and related rocks in the northern Delaware Basin of southeastern New Mexico. Most confined Rustler waters at the Waste Isolation Pilot Plant (WIPP) site and to the west in Nash Draw and confined waters from the Capitan limestone constitute one population in $\delta D/\delta^{18}O$ space, while unconfined groundwaters inferred to originate as modern surface recharge to alluvium, sandstones in the Ogallala Formation, the near-surface Rustler in southwestern Nash Draw, and the Capitan vadose zone in the Guadalupe Mountains (Carlsbad Caverns) constitute a distinctly different population; the two do not overlap. A likely explanation for this distinction is that meteoric recharge to most of the Rustler and Capitan took place in the geologic past under climatic conditions significantly different from the present. Available tritium and radiocarbon data are consistent with this hypothesis, and the apparent age of confined

groundwaters is in excess of 12,000 radiocarbon years, suggesting that recharge took place under wetter conditions in the late Pleistocene. Processes governing recharge in the Delaware Basin are significantly different from those in the nearby Roswell Artesian Basin, but may be similar to those previously described for the Albuquerque (New Mexico) and Murray (South Australia) Basins. 133 refs.

19386 (SAND—88-2936) Technical correspondence in support of an evaluation of the hydrologic effects of exploratory shaft facility construction at Yucca Mountain. Peterson, A.C.; Eaton, R.R.; Russo, A.J.; Lewin, J.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 119p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008319/JAW.

This document comprises four letter reports containing information that has been used in preparing the plan to characterize the site of the prospective repository at Yucca Mountain. The Yucca Mountain Project is studying the feasibility of constructing a high-level nuclear waste repository in the Topopah Spring Unit of the Paintbrush Tuff. One activity of site characterization is the construction of two exploratory shafts. The information in this report pertains to (1) engineering calculations of the potential distribution of residual water from constructing the exploratory shafts and drifts, (2) numerical calculations predicting the movement of the residual construction water from the shaft walls into the rock, (3) numerical calculations of the movement of the residual water and how the movement is affected by ventilation, and (4) measurement of the movement of water into a welded tuff core when a pulse of water pressure is applied to a laboratory test sample for a short time (100 min).

19387 (UCID—21542-88-2) Plutonium Residue Recovery (PuRR) Project: Quarterly progress report, July-September 1988. Pittenger, L.C.; Alire, R.M.; Coops, M.S.; Landrum, J.H.; Priest, R.E.; Thompson, D.S.; Gregg, D.W.; Pierce, R.D.; Johnson, G.K.; Mulcahey, T.P. (Lawrence Livermore National Lab., CA (USA)). 12 Dec 1988. Contract W-7405-ENG-48. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007686/JAW.

During this quarter, process development activities were concentrated on methods for recycling the salt and alloy reagents used by PuRR. Promising techniques were identified for further investigation, development and refinement. Processes for the recycling of salts, in particular, were also shown to be of potential benefit in reducing waste streams in the current plutonium metal production cycle. At Argonne National Laboratory (ANL), the first attempt at reduction of ash heels was made. The recovery of plutonium from this most intractable of residues was gratifyingly high. Magnesium was used for reduction of ash heel into a zinc alloy, and calcium was used for reduction into a copper-magnesium alloy. For the zinc-magnesium run 99.9% reduction was achieved in two reduction stages. For the copper-magnesium-calcium run, 99.8% reduction was obtained in a single stage. The reduction alloy from the copper-magnesium-calcium system was subjected to salt extraction by reaction with $CdCl_2$. Only 96.5% of the reduced plutonium was extracted. Quantitative extraction was expected; the cause for the incomplete extraction will be investigated. A similar salt extraction will be performed with the reduction ingot from the zinc-magnesium system. At Lawrence Livermore National Laboratory (LLNL), further progress was made toward readying the gloveboxes in the Plutonium Facility for use. Preliminary steps were taken to prepare ash-heel residues for experiments to attempt gross mechanical separation as a head-end stage for PuRR. 3 refs., 3 figs.

19388 (UJV—8410-CH) Selected problems of the minimization and processing of radioactive wastes arising from nuclear power plants decommissioning. Kyrs, M.; Moravec, A. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). May 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705601/JAW.

Literature data is presented covering the strategy of nuclear power plants decommissioning, the amount of produced wastes and their radioactivity, the problems of the relative amount of different types of wastes, the classification of wastes of various origins, as well as the specific characteristics of decontamination related to nuclear power plants decommissioning. Experience and problems are summed up presented in recent publications dealing with wastes from nuclear power plant decommissioning. 1 fig., 6 tabs., 29 refs.

19389 (VROM—70727-9-87) Basis note in behalf of the development of a test criterion for the storage of radioactive waste. (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands). Hoofdinspectie voor de Hygiene van Het Milieu). Sep 1987. 80p. (In Dutch). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88706134/JAW.

Aspects are described which may play a role in the development of a criterion for a final storage of radioactive waste. Such a criterion consists of a set of requirements concerning the quality of environment and public health, with which a proposal for the final storage of the waste has to be compared. The criterion should be able to give decisive answers regarding the acceptibility of a storage but should also be useful for the judgment of risk-analyses which are therefore necessary. 10 refs.; 9 figs.; 3 tabs.

19390 (WHC-EP—0229) Double-Shell Tank Waste Disposal Integration Plan. Kirch, N.W. (Westinghouse Hanford Co., Richland, WA (USA)). Feb 1989. Contract AC06-87RL10930. 81p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008193/JAW.

The Plan, hereafter, referred to as the IP, defines the baseline processes, scope, schedule, and budget for implementation of double-shell tank waste disposal (DSTWD). The IP also defines the procedure for changing the baseline. The objective of the DSTWD Program is retrieval, pretreatment, and eventual solidification of all double-shell tank (DST) wastes. The tasks needed to meet this objective reside in the respective programmatic end functions for planning, budget, cost, and schedule reporting. These are the Defense High-Level Waste Technology Program; Tank Farm Programs; Waste Fractionization/Encapsulation Program; Hanford Waste Vitrification Plant Project; and Grout Disposal Program.

19391 Risk perception as it applies to nuclear power and nuclear waste disposal. Sprecher, W.M. (Office of Civilian Radioactive Waste Management, U.S. Dept. of Energy, Washington, DC (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 60-65(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Disparate perceptions of risk have emerged as one of the critical issues confronting the future of commercial nuclear power. This paper explores the origins and possible ramifications of the public's perception of risks associated with commercial nuclear power and related high-level nuclear waste disposal programs. This paper summarizes the results of numerous psychometric studies and public opinion polls that analyze the relationship of risk to nuclear power and waste management.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 19324, 19326, 19327, 19328, 19337, 19338, 19339, 19340, 19341, 19342, 19343, 19344, 19345, 19346, 19347, 19350, 19352, 19355, 19357, 19366, 19367, 19379, 19381, 19384, 19385, 19386, 19390, 19393, 20625

0540 Health And Safety

REFER ALSO TO CITATION(S) 19314, 19369, 19391, 19643, 20122, 20224

19392 (CONF-8811174—1) Radiological characterization of soils. Eldridge, J.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006629/JAW.

From Workshop on the management of contaminated soils; Knoxville, TN, USA (10 Nov 1988).

By use of several case histories as well as personal experience of the author, it is possible to make general commendations

for soil characterization. A list is presented. Radiological characterization of soils is usually a joint effort between applied health physics and radiochemical personnel. For "best management practice," include laboratory personnel in planning phase. Use a laboratory with experience in measuring natural levels of radioactivity. Determine the nature of the contamination from historical records if possible. Make a preliminary estimate of the contamination extent from historical records. Obtain maps and conduct a civil engineering survey if a large area is involved. Place "grid" markers during the survey. Conduct a surface survey with appropriate portable instruments. Based on the surface surveys or for other reasons, take surface and subsurface samples at points of maximum activity of preliminary data. Ensure that subsurface is sampled deep enough to encompass the contamination. Use coarse "screening procedure" (if suitable) on "wet" samples to conserve analytical costs. Dry, grind, blend, and aliquot samples for formal analyses. Use best QA/QC principles.

19393 **(DOE/OR/21548—011-Rev.0) Remedial investigation quality assurance program plan: Weldon Spring Site Remedial Action Project: Revision 0.** (MK-Ferguson Co., St. Charles, MO (USA)). Dec 1988. Contract AC05-86OR21548. 61p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008272/JAW.

The Remedial Investigations Quality Assurance Program Plan (RIQAPP) for Weldon Spring Site Remedial Action Project (WSSRAP) is distinguished by purpose from the WSSRAP overall Quality Assurance/Quality Control Program Plan (QAPP). The RIQAPP is focused only on meeting EPA requirements under CERCLA whereas the QAPP is designed to meet quality assurance program requirements for nuclear facilities. The RIQAPP specifically addresses factors, methods and criteria. Specific QC procedures are contained in existing documents incorporated into the plan by reference. These include Standard Operating Procedures, laboratory QA procedures, and activity level sampling plans. The existing procedures provide many of the required QA elements: measurement, sampling, sample and document custody and control, calibration, analysis and data reduction, validation and reporting. Addition QA elements addressed in the RIQAPP include performance and system audits, surveillance, and reporting and correction of deficiencies. System audits, on a regularly scheduled basis, will evaluate all components of measurement systems to determine capability, proper selection and use. Performance audits, on a scheduled basis, will determine adequacy and accuracy of a given measurement system and/or procedural compliance. Surveillance, both scheduled and unscheduled, of field and laboratory activities will be performed to verify conformance to specified requirements. 8 refs., 1 fig., 1 tab.

19394 (INIS-BR—1411, pp 228-238) **Regional radiation protection center in the Federal Republic of Germany - Tasks and Organization.** Koelzer, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

In the Federal Republic of Germany 220,000 staff members are classified at the moment as occupationally radiation exposed persons. For the maintenance of industrial health and safety for the workers in the companies and for the medical, professional and social rehabilitaion after an accident the so-called "Berufsgenossenschaften" (professional trade associations) are responsible. For employees in nuclear industry two trade associations are competent: - the Trade Association for Precision Engineering and Electrical Engineering for the 6,000 employees in nuclear power plants, - the Trade Association of the Chemical Industry for the 4,000 employees in fuel element fabrication and the reprocessing companies. In case of an accident workers from service companies e.g. construction and installation companies could be affected as well. Therefore these trade associations have founded a couple of years ago an "Institute for Radiation Protection". A special task of this institute is First Aid to overexposed people in case of radiation accidents. In addition, it organizes the 24-hours-service of the seven Regional Radiation Protection Centers of Federal Republic of Germany. The institute provides special training of radiation protection physicians and occupationally radiation exposed persons.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 19319, 19391, 19581, 20133, 20257

19395 **(AIAU—88309) Laser surveillance system (LASSY).** Boeck, H.; Hammer, J. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. 27p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705961/JAW.

The development progress during the reporting period 1988 of the laser surveillance system of spent fuel pools is summarized. The present engineered system comes close to a final version for field application as all technical questions have been solved in 1988. 14 figs., 1 tab.

19396 **(K/ITP—245) Training course on nuclear material safeguards for enrichment plants, Vienna, Austria, November 14--18, 1988: Report of foreign travel.** Cooley, J.N.; Swindle, D.W. Jr.; Von Halle, E. (Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.). Feb 1989. Contract AC05-84OT21400. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007740/JAW.

J. N. Cooley, manager, Safeguards Studies Department; E. Von Halle, head, Technical Resources Section; and D. W. Swindle, Jr., director, International Technology Programs Division, Martin Marietta Energy Systems, Inc., traveled to Vienna, Austria, November 9--20, 1988, to conduct a 5-day uranium enrichment safeguards training course for the International Atomic Energy Agency (IAEA). The course was developed and conducted by Energy Systems for the IAEA through the US. Program for Technical Assistance to IAEA Safeguards (POTAS) under Task B.48. Titled "Nuclear Material Safeguards for Enrichment Plants," this second session of the course was held on November 14--18, 1988, for 15 IAEA inspectorate and support division personnel. The course was developed and initially taught in 1987 to train IAEA professionals whose responsibilities require knowledge of safeguarding nuclear material at enrichment plants on the safeguards-relevant principles of enrichment technology, particularly as related to centrifuge enrichment facilities. Based on comments received during initial training session, the course and reference materials were revised, updated, and expanded. The main objective of the course is to provide participants with the necessary skills to perform their inspection activities at enrichment plants. Overall, the course was very well received; the four-part course manual was especially appreciated because of the text accompanying the view graphs. The general consensus was that the course should be repeated so that inspectors who could not be accommodated in this session will have a chance to be trained in this important area of safeguards.

19397 **(SRDP-PR—8) UK Safeguards R and D Project progress report for the period May 1987 -April 1988.** Packer, T.W. (ed.). (UKAEA Harwell Lab. Safeguards R and D Project). Sep 1988. 30p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706132/JAW.

The main categories of task included in the United Kingdom safeguards research and development programme are summarised in the first section. These are: tasks concerned with the development of instruments and techniques for reprocessing and centrifuge enrichment plant safeguards; tasks concerned with the development of instruments and techniques for general application in the field of safeguards; tasks which are services to the International Atomic Energy Authority and exploratory and short term tasks which occur from time to time. The next three sections contain progress reports on the individual tasks and section 6 lists reports and papers relevant to work on UK safeguards research and development published between May 1987 and April 1988. (U.K.).

19398 **An integrated approach to validation of safeguards and security program performance.** Altman, W.D.; Hunt, J.S.; Hockert, J.W. (Lawrence Livermore National Lab., Livermore, CA (US); ERC International, Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 112-118(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Department of Energy (DOE) requirements for safeguards and security programs are becoming increasingly performance oriented. Master Safeguards and Security Agreemtns specify performance levels for systems protecting DOE security interests. In order to measure and validate security system performance, Lawrence Livermore National Laboratory (LLNL) has developed cost effective validation tools and a comprehensive validation approach that synthesizes information gained from different activities such as force on force exercises, limited scope performance tests, equipment testing, vulnerability analyses, and computer modeling; into an overall assessment of the performance of the protection system. The analytic approach employs logic diagrams adapted from the fault and event trees used in probabilistic risk assessment. The synthesis of the results from the various validation activities is accomplished using a method developed by LLNL, based upon Bayes' theorem.

19399 **A variable scheduling technique for OSE inspections.** Allentuck, J.; Kok, K. (Brookhaven National Lab., Upton, NY (US); Battelle Columbus Div., Columbus, OH (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 599-604(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Office of Security Evaluations (OSE) of the Department of Energy (DOE) is charged with evaluating the effectiveness of DOE safeguards and security programs and policies. This responsibility has been met by performing inspections on a fixed frequency at intervals established in 1984 by precedent. In the face of limited resources, and considering the major improvements in safeguards and security throughout the complex, one must now establish inspection frequencies on a more analytical basis. To satisfy this need a methodology has been developed for scheduling inspections at variable frequencies. Here inspection frequency of a facility is determined by (a) the facility's relative ranking based on risk management considerations, and (2) the resources available for inspection. A facility's relative rank in an inspection priority list of DOE facilities is based on a parameter which is a function of threat, vulnerability, and consequences (TVC). In addition to prioritizing facilities, inspection topics for a given facility can be established using the methodology.

19400 **High bandwidth real time frequency modulated (FM) video link for security and tactical applications.** Lupinetti, F. (Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 522-529(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

With the increasing demand for in situ unmanned reconnaissance, security control, and intrusion detection, the capability of transmitting and receeiving video information from remote locations has become of paramount importance. This capability can be achieved by appropriately deploying radio frequency (RF) video links which can readily be interfaced with sensors, humans, or other RF links. The video link described in this paper was designed and implemented for security and tactical applications which require medium power, low complexity, rugged link capable of direct transmission and reception of FM modulated, high quality, full-color video signals in the low portion (470-806 MHz0 of the UHF frequency band (300-3000 MHz). The transmitter portion of the link is tubable. It is of the direct modulation (FM and RF simultaneously) type. The receiver is of the direct detection type with no need for any downconversion. Both transmitter and receiver are currently being tested for mobile and fixed applications at the Sandia Robotic Vehicle Rangle. Ranges in excess of 10 Km and simultaneous transmission and reception of three adjacent channels have been achieved using omnidirectional antennas.

19401 **Modular integrated video system (MIVS) review station.** Garcia, M.L. (Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 891-894(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

An unattended video surveillance unit, the Modular Integrated Video System (MIVS), has been developed by Sandia National Laboratories for International Safeguards use. An important support element of this system is a semi-automatic Review Station. Four component modules, including an 8 mm video tape recorder, a 4-inch video monitor, a power supply and control electronics utilizing a liquid crystal display (LCD) are mounted in a suitcase for probability. The unit communicates through the interactive, menu-driven LCD and may be operated on facility power through the world. During surveillance, the MIVS records video information at specified time intervals, while also inserting consecutive scene numbers and tamper event information. Using either of two available modes of operation, the Review Station reads the inserted information and counts the number of missed scenes and/or tamper events encountered on the tapes, and reports this to the user on the LCD. At the end of a review session, the system will summarize the results of the review, stop the recorder, and advise the user of the completion of the review. In addition, the Review Station will check for any video loss on the tape.

19402 **Security features of a nuclear material accounting system.** Erkkila, B.H. (Los Alamos National Lab., Los Alamos, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 126-127(1988). (CONF-880631—).

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The Los Alamos Nuclear Material Accounting and Safeguards System (MASS) is a near-real-time accountability system for bulk materials, discrete items, and materials undergoing dynamic processing. MASS has evolved from a 80-column, card-based process control system to a very sophisticated computer system. Recently, the computer hardware was upgraded to a modern transaction oriented central computer system designed to accommodate extensive growth in the foreseeable future. The security of the MASS computer system is provided through various access controls. There are two kinds of access controls to be addressed. They are physical access control to the hardware which make up the system and access control to the software. There are many features which provide a measure of security to the hardware that are discussed. Access to the software is controlled by a security password. Access to various transaction activities in the system is controlled through the level of MASS under privilege. Details of MASS user privilege are discussed.

19403 **A systematic method for protecting industrial production from sabotage.** Vannoni, M.G.; Kieldgaard, E.A.; Varnado, G.B.; Hockert, J.W. (Sandia National Labs., Albuquerque, NM (US); ERCI Inc., Albuquerque,, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 82-85(1988). (CONF-880631—).

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The U.S. DOE initiated the Production Risk Evaluation Program (PREP) at Sandia National Laboratoires (SNL) to assess quantitatively the potential for serious production disruption as the result of random failures, accidents, natural disasters, or sabotage at its facilities. SNL developed a procedure incorporating both network and fault tree models that identifies production vulnerabilities. For each production step, a steady-state flow model computes the "critical time," which is the maximum period a step can be shut down without preventing the system from achieving production goals. The critical time is then used in fault tree analysis to determine the failure modes that can stop the process for longer than this period. Modular logic modeling is used for constructing the fault trees. Equipment restorable within it s critical time need not be considered critical even though it may perform significant work. The PREP models can be used to identify those plant areas to which a saboteur would need to gain access. A security strategy using graded protection could potentially save money. PREP methods also provide quantitative insights to develop protection measures that do not infringe upon the liberties of personnel or complicate work practices.

19404 **A consequence index approach to identifying radiological sabotage targets.** Altman, W.D.; Hockert, J.W. (Lawrence Livermore National Lab., Livermore, CA (US); ERC International, Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 79-81(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

One of the threats to concern to facilities using significant quantities of radioactive material is radiological sabotage. Both the Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission have issued guidance to facilities for radiological sabotage protection. At those facilities where the inventories of radioactive materials change frequently, there is an operational need for a technically defensible method of determining whether or not the inventory of radioactive material at a given facility poses a potential radiological sabotage risk. In order to determine quickly whether a building is a potential radiological sabotage target, Lawrence Livermore National Loaboratory (LLNL) has developed a radiological sabotage consequence index that provides a conservative estimate of the maximum potential off-site consequences of a radiological sabotage attempt involving the facility. This radiological sabotage consequence index can be used by safeguards and security staff to rapidly determine whether a change in building operations poses a potential radiological sabotage risk. In those cases where such a potential risk is identified, a more detailed radiological sabotage vulnerability analysis can be performed.

19405 **Evaluation of MC and A in the U.S. Department of Energy's complex by the National Academy of Sciences.** March, F.; Hagis, W. (Energy Engineering Board, National Academy of Sciences, Washington, DC (US); US Dept. of Energy, Office of Safeguards and Security, DP-341, Washington, DC (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 31-35(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper describes the process which the National Academy of Sciences, (NAS) employed when they were asked to evaluate MC and A practices and management in the Department of Energy's (DOE) nuclear weapons and fuel production complex. The study committee was formed which consisted of persons from various disciplines, serving on a voluntary basis. It was composed of participants from industry, academe and government, approximately evenly divided and of specialists with nuclear and non-nuclear backgrounds. The committee produced a report on its findings and has made a number of recommendations to the DOE. This paper is a case study of the unique and problematic evaluation process of the committee. Since this is the first NAS committee to interact with the DOE complex, it is also of interest to examine the experience in terms of the motives and expectations of the DOE, the method of performance by the committee, and the substantive issues raised for committee consideration in the course of a three-day workshop, attended by over 70 experts associated with this nation's nuclear defense programs.

19406 **Master safeguards and security agreements and protection program planning orders and guide.** Hensley, B. (U.S. Dept. of Energy, Washington, DC (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 471-473(1988). (CONF-880631—).

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This paper discusses the Master Safeguards and Security Agreement (MSSA) and Protection Program Planning (PPP) orders of the Department of Energy (DOE). Both orders establish DOE policy, requirements, responsibilities, and authorities for the development and implementation of MSSA's and associated planning documents. The MSSA subcommittee to the Policy Development Task Force was responsible for the development of the MSSA order. Unlike other subcommittees that were involved in updating existing orders, the AMSSA subcommittee produced the initial version of the MSSA order. The subcommittee included representation from DOE outlay program offices with Headquarters and field office safeguards and security expertise. The PPP order was developed by a separate subcommittee and included representation mainly from the Task Force itself. It was completed much later than the other orders and remains under review within the Department.

19407 **Technology transfer significance of the International Safeguards Project Office.** Marcuse, W.; Wallgura, A.J. (Brookhaven National Lab., Upton, NY (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 237-241(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The safeguards implemented by the International Atomic Energy Agency (IAEA) are of major importance to the non-proliferation objectives of the United States of America and other nations of the world. Assurance of safeguards effectiveness is mandatory to continued peaceful use of nuclear power. To enhance the ability of the IAEA to apply safeguards effectively, and to ensure that the IAEA does not lack technical assistance in critical areas, the U.S. Congress has made available a special authorization for a Program for Technical Assistance to IAEA Safeguards (POTAS). In expediting the program full use is made of existing DOE laboratory resources.

19408 **Mechanisms for training security inspectors to enhance human performance.** Burkhalter, H.E.; Sessions, J.C. (Los Alamos National Lab., Los Alamos, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 941-946(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Department of Energy (DOE) has established qualification standards for protective force personnel employed at nuclear facilities [10 CFR Part 1046 (Federal Register)]. Training mechanisms used at Los Alamos to enhance human performance in meeting DOE standards include, but are not limited to, the following: for cardio-respiratory training, they utilize distance running, interval training, sprint training, pacing, indoor aerobics and circuit training; for muscular strength, free weights, weight machines, light hand weights, grip strength conditioners, and calistenics are employed; for muscular endurance, participants do high repetitions (15 - 40) using dumbbells, flex weights, resistive rubber bands, benches, and calisthenics; for flexibility, each training session devotes specific times to stretch the muscles involved for a particular activity. These training mechanisms with specific protocols can enhance human performance.

19409 **The use of process information for verification of inventory in solvent extraction contactors in near-real-time accounting for reprocessing plants.** Hakkila, E.A.; Barnes, J.W.; Hafer, J.F. (Safeguards Systems Group, Los Alamos National Lab., Los Alamos, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 866-870(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Near-real-time accounting is being studied as a technique for improving the timeliness of accounting in nuclear fuel reprocessing plants. A major criticism of near-real-time accounting is perceived disclosure of proprietary data for IAEA verification, particularly in verifying the inventory of solvent extraction contractors. This study indicates that the contribution of uncertainties in estimating the inventory of pulsed columns or mixer settlers may be insignificant compared to uncertainties in measured throughput and measurable inventory for most reprocessing plants, and verification may not be a serious problem. Verification can become a problem for plants with low throughput and low inventory in tasks if contactor inventory variations or uncertainties are greater than —25%. Each plant must be evaluated with respect to its specific inventory and throughput characteristics.

19410 **Neutralization and system effectiveness.** Paulus, W.K. (Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 434-440(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Security forces that can neutralize an attack force are essential to effectively safeguard special nuclear material (SNM) against theft or sabotage. Probability of neutralization, P(N), estimates the likelihood that security forces will win given that security forces interrupt the attackers and begin an armed engagement. Brief Adversary Threat Loss Estimator (BATLE) calculates P(N). BATLE was developed for the Nuclear Regulatory Commission in 1980. This paper describes a total repackaging of BATLE called the Threat Neutralization Model. New features and capabilities are (1) guidance to the user in setting up the input parameters, (2) faster software, (3) graphical output and sensitivity curves to assist the user in interpreting the results, (4) compatibility with the SAVI vulnerability analysis program, and (5) operation under Microsoft Windows on personal computers.

19411 **An orientation program for U.S. citizens going to the IAEA.** Sanders, K.E.; Weinstock, E.V. (U.S. Arms Control and Disarmament Agency, Washington, DC (US); Brookhaven National Lab., Upton, NY (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 210-217(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

An orientation program for U.S. citizens accepting safeguards positions at the International Atomic Energy Agency is under development. Its purpose is to help prepare new U.S. IAEA employees and their spouses for the unique environment in which they will find themselves while living in Vienna and working at the IAEA. The material covered will include the following main subjects: U.S. non- proliferation policy, the history, nature, and role of the IAEA in that policy, the IAEA safeguards system, the U.S. Program for Technical Assistance to IAEA Safegyuards (POTAS), working at the IAEA, and moving to and living in Vienna. The delivery will include oral briefings by representatives of the International Safeguards Project Office (Brookhaven National Laboratory) and appropriate government agencies, and group, one-on-one, or workshop-type discussions led by consultants on Vienna and cross-cultural adaptation. The program is designed for both the employee and his or her spouse. For convenient further self-study, a course manual covering the above topics will be prepared.

19412 **Evaluation of accountability measurements.** Cacic, C.G. (U.S. DOE New Brunswick Lab., 9800 S. Cass Avenue, Bldg. 350, Argonne, IL (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 581-586(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The New Brunswick Laboratory (NBL) is programmatically responsible to the U.S. Department of Energy (DOE) Office of Safeguards and Security (OSS) for providing independent review and evaluation of accountability measurement technology in DOE nuclear facilities. This function is addressed in part through the NBL Safegaurds Measurement Evaluation (SME) Program. The SME Program utilizes both on-site review of measurement methods along with material-specific measurement evaluation studies to provide information concerning the adequacy of subject accountability measurements. This paper reviews SME Program activities for the 1986-87 time period, with emphasis on noted improvements in measurement capabilities. Continued evolution of the SME Program to respond to changing safeguards concerns is discussed.

19413 **Means for meeting the MC and A performance requirements of DOE Order 5633.3.** Kane, W.R.; Keisch, B.; Sanborn, J.B.; Suda, S.C. (Brookhaven National Lab., Upton, NY (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 594-598(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

DOE Order 5633.3., Control and Accountability of Nuclear Materials, includes specific performance requirements that a facility's safeguards system must meet. The performance criteria specify the ability of the system to detect the loss of a given quantity of material in terms of a detection probability and a time to detection. In order to determine that a facility meets the performance requirements of the Order, quantitative evaluation techniques must be developed which can be applied uniformly and objectively to DOE facilities. Methods by which a facility may evaluate its program against the performance criteria of the Order and by which the field office may conduct review and oversight of the facility's program have been developed. They have been incorporated into two guides for the use of the facilities and field offices respectively.

19414 **Development of performance tests for an automated MC and A system.** Kok, K.D.; Klingensmith, R.W.; Riffle, W.; Carver, R.D.; Schumacher, S.S.; Lavender, J.C.; Smith, B.W. (Battelle Columbus Div., Columbus, OH (US); US Dept. of Energy, Washington, DC (US); Lawrence Livermore National Lab., Livermore, CA (US); Pacific Northwest Lab., Richland, WA (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 587-593(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Performance tests of MC and A systems using computers are described, and some example scenarios are discussed. Facility personnel or an external inspection group may use performance tests to evaluate MC and A capabilities under actual operating conditions. This paper addresses test elements common to both user groups. Performance tests consist of scenario development, security, and safety measures, conduct, and evaluation. Because exercises often test scenarios against which the MC and A system is protecting, they may require additional security and safety measures. Computer systems enhance MC and A by providing greater speed, increased precision, and automated checks. Performance tests for MC and A systems using computers differ from performance tests employing manual data systems in that the scenarios must anticipate computer actions rather than utilize controllers to adjust the scenario.

19415 **Enhancing the role of C/S in international safeguards.** Sonnier, C.S.; Walford, F.J. (Sandia National Labs., Albuquerque, NM (US); UKAEA Harwell, Oxfordshire (GB)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 656-658(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Containment and Surveillance (C/S) is commonly referred to as a complementary safeguards measure, intended to maintain continuity of knowledge between inventory intervals. With the emergence of large, automated facilities, and extended dry storage of spent fuel in casks, nuclear material is often very difficult and costly to access for measurements associated with inventory taking. In these cases, and with the limited resources of the IAEA, much more reliance is expected to be placed on C/S. This paper describes the needs to enhance the role of C/S to a level which may permit consideration of reduced measurements without loss of safeguards assurances. Principal topics include recent opinions within the International Safeguards Community regarding the importance of C/S, redundancy of C/S equipment, and the emergence of integrated C/S systems provided by facility operators and the authentication thereof.

19416 **Recent developments in fast calorimetry.** Perry, R.B.; Fiarman, S. (Argonne National Lab., Argonne, IL (US); Brookhaven National Lab., Upton, NY (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 694-698(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

A need for faster plutonium calorimetric assay measurments at several DOE plutonium facilities has been established. A method for reducing the measurement time of an ANL air-bath bulk calorimeter to less than 20 minutes for bulk samples was proposed, and a field test to gather additional data and develop the best measurement protocol was conducted. Improvements in the sample preheating, data acquisition hardware, and prediction algorithm software were made to optimize the performance of an ANL air-bath calorimeter for fast measurements. The modified calorimeter was tested at ANL and at Rocky Flats on a limited number of samples in the 1-4 watt range. The measurement time was 17-18 minutes with a precision of less than 1%. A new air-bath bulk calorimeter with a lower power range and larger sample diameter incorporat-

ing the fast measurement technology has been proposed. The new instrument could be ready for testing in 12 months.

19417 **Testing of a low-cost item monitoring system.** Frank, D.J.; Cunningham, K.R.; Hoover, C.E.; Trujillo, A.A. (Rockwell International, Rocky Flats Plant, Golden, CO (US); Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 809-814(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Material control is an important element of any security system which seeks to address the insider threat. Sandia has developed Wireless Alarm Transmission of Container Handling (WATCH) which is a remote sensory system that provides a low-cost, convenient way of monitoring item movement. Rockwell International/Rocky Flats Plant (RFP) and Sandia have conducted a long-term evaluation of the WATCH system in an operating production facility. Testing was conducted in a large scale, remote access storage vault for Special Nuclear Materials (SNM). A total of fourteen WATCH units were placed on storage containers in the vault. A schedule was established which provided prearranged movement of monitored containers on a regular basis. The test objectives were to determine 1) the feasibility of using the WATCH system technology to implement material control concepts, 2) the system performance in an active production area, and high radiation environment, 3) the sensitivity settings required for optimum system performance, and 4) the spatial resolution of the transmitter/receiver utilized.

19418 **U.S. statutes of general interest to safeguards and security officers.** Cadwell, J.J. (Technical Support Organization, Brookhaven National Lab., Upton, NY (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 453-454(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

A handbook of enforcement provisions of Federal law and regulations was prepared for use by U.S. DOE Security Inspectors. This handbook provides security inspectors for the U.S. Department of Energy, security officers at Nuclear Regulatory Licensee facilities, and others with a single document containing most of the Federal law provisions available to assist them in enforcing agency regulations. The handbook contains selected enforcement provisions of Titles 18, 42 and 50 of the United States Code (USC). Topical coverage of Title 18 includes Espionage and Misrepresentation or Impersonation; Theft and Embezzlement; Malicious Mischief; Conspiracy; Search and Seizure. A miscellaneous section deals with explosives, blackmail, firearms, and other subjects. Certain enforcement sections of Title 42 of the USC (The Atomic Energy Act) and of the Internal Security Act of the United States Code (Title 50) are also provided. Finally, relevant parts of the Federal Property Management Regulations of Title 50, Chapter 101 of the Code of Federal Regulations are presented. A comprehensive index is provided based on key words.

19419 **Material control and accountability orders.** Jewell, D.L. (U.S. Dept. of Energy, Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 464-467(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Department of Energy's (DOE) Material Control and Accountability (MC and A) Orders were revised during this past year. The primary focus of the revision process was to eliminate any policy gaps that existed between current orders and the standards and criteria and to examine current policy where questions of completeness or effectiveness may be of concern. The MC and A Subtask Group identified the following three major areas for change: (1) the need to expand the graded safeguards concept; (2) the need to provide for defense in depth; and (3) the need to include system performance requirements. Operational and cost impacts were of primary consideration in these changes. The subtask group accomplished its goal as directed and within the required time frames. The revision process benefitted tremendously from the earlier works of the numerous standards and criteria committees and the Operation Cerberus Committees.

19420 **Information management in the design of materials control and accountability systems.** Whitty, W.J. (Safeguards Systems Group, Los Alamos National Lab., Los Alamos, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 305-311(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

In the initial stage of a materials accounting system design, fundamental decisions are made about the data to be acquired, the means for acquisition, and the location and timing of the acquisition. The data to be acquired are determined by their intended use in the analysis, reporting, and decision processes. This paper presents information management methods for materials accounting systems based on experience in system development at DOE facilities. Specifically, the authors describe principles for the acquisition and organization of data for a materials control and accountability (MC and A) system.

19421 **A task and technical support sensitive security operations center.** Newell, R.A.; Sena, P.A.; Salazar, J.S. (Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 447-452(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Modern security control and display systems for protected facilities have improved the effectiveness of Security Operations Center (SOC) personnel. The most effective of these utilize sophisticated computerized systems to primarily provide quick and accurate control and display of alarm associated and routine access functions. This paper describes a design approach, consisting of four independent building blocks, that provides functionality and complexity commensurate with facility-specific requirements and technical support capabilities. The versatility of the design is demonstrated by showing how the less complex blocks satisfy the needs of fiscally limited facilities or the blocks can be integrated to satisfy the needs of the largest security installations. Also, the independent blocks can be integrated into existing installations to provide needed additional functionality with minimal impact on operations and existing equipment.

19422 **Optimizing man-machine performance of a personnel access restriction security system.** Banks, W.W.; Moore, J.W. (Lawrence Livermore National Lab., Livermore, CA (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 938-940(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper describes a human engineering design and analysis effort for a major security system upgrade at a DOE facility. This upgrade was accomplished by replacing an obsolete and poorly human engineered security screening both the with a new, user oriented, semiautomated, computer-based access control system. Human factors engineers assisted the designer staff in specifying a security access interface to physically and cognitively accommodate all employees which included handicapped individuals in wheel chairs, and several employees who were severely disabled, both visually and aurally. The new access system was intended to control entry into sensitive exclusion areas by requiring personnel to enter a security screening booth and interact with card reader devices and a-simple-to-operate access control panel system. Extensive man-machine testing with prototype mock-ups was conducted to assess human engineered design features and to illuminate potentially confusing or difficult-to-operated hardware placement, layout, and operation sequencing. These evaluations, along with the prototype mock-ups, provided input which resulted in a prototype which was easy to enter, operate, and understand by end users. This prototype later served as the design basis for the final systems design.

19423 **Evaluation of a real-time personnel and material tracking system.** Trujillo, A.A.; Hoover, C.E.; Garcia, B.A. (Sandia National Labs., Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 783-788(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Past experience in addressing the insider threat has led to the development of general principles for mitigating the insider threat while minimizing adverse impacts on site operations. Among the general principles developed was the requirement of a real-time personnel and material tracking system. A real-time system for personnel and material tracking will aid in mitigating the insider threat by providing critical information regarding the movement and location of personnel and material. In addition, this system can provide an early detection mechanism for potential insider actions. A system integrating Radio Frequency (RF) transmitters for real-time personnel and material tracking has been developed. This system was installed and tested in an operational environment. This test was intended to demonstrate the system's ability to successfully control access to material and areas by personnel, as well as providing information regarding the status of materials in transit and storage.

19424 **High enriched uranium physical inventory verification exercise.** Cuypers, M.; Franklin, M.; Guardini, S.; Rota, T.; Haas, R.; Verrecchia, G.P.D.; Zadeh, R.A.; Belew, W.; Krick, M.; Menlove, H. (Commission of the European Communities (Ispra) (IT); Euratom (LU); IAEA-Vienna (AT)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 371-377(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper presents the results from a High Enriched Uraniuum Physical Inventory Exercise performed under a collaboration between the Commission of the European Communities (CEC) and the International Safeguards Project Office of the U.S. Dept. of Energy. The exercise was held in Ispra, Italy, during the 6th to the 17th of July 1985 with twelve participants, eight IAEA, and four Euratom safeguards inspectors. The participants working as independent teams of four, two IAEA and one Euratom, successfully carried out all activities of a PIV, including inventory stratification, preparation of sampling plans, nuclear material verification by NDA measurement techniques, and evaluation of the data, including MUF, D and their standard deviations. The instruments included IAEA and Euracom instruments based on neutron and gamma measurement techniques. The paper describes the course content and some discussion of what lessons have been learned for inspector training.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 19318, 19329, 19391, 19398, 19401, 19404, 19405, 19406, 19407, 19411, 19412, 19413, 19418, 19419, 19420

19425 **Faster, less expensive package certifications.** Leonard, J.F. (U.S. Dept. of Energy, Germantown, MD (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 156-159(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The U.S. Department of Energy Packaging Certification Staff (PCS) has been reviewing ways to shorten the radioactive material packaging certification process and reduce the overall costs of obtaining certification. The PCS can help to identify existing certified packaging designs that may meet a shipper's needs. If it is necessary to design a new packaging, then the fastest, easiest way toward certification is through the use of common designs and materials already familiar to the PCS (though this is not always possible or desirable). The shipper should be realistic about the amount of time, money, and documentation necessary to obtain a certification, and should involve the PCS early in the planning of the packaging. The PCS will not do design work or recommend a design, but can warn of potential pitfalls. The Safety Analysis Report for Packaging (SARP) is the basis for certification; therefore, the adequacy of the SARP should be the focal point of all efforts toward certification. Technical services provided by the PCS can help in the preparation of the SARP and can accelerate the certification process.

19426 **Development of a model "use of intermediate force" policy and training program for the Department of Energy.** Glick, L.; Graves, B.; Leamons, T. (U.S. Dept. of Energy Central Training Academy, Albuquerque, NM (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 954(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Department of Energy Central Training Academy has been tasked with the development of a model program to standardize general philosophy, policy, training curriculum, and use of intermediate force tools, equipment, and techniques by protective force personnel at Department of Energy contractor facilities. The paper encompasses applicable Department of Energy authority delineating protective force personnel duties, arrest and use of force authority and procedural guidelines, case law relevant to the use of less than lethal or intermediate force, recommended guidelines, and training and certification recommendations. Implementation of a standardized program for the Department of Energy will enhance the capability of protective force personnel to fulfill their varied and complex mission using only the minimum control necessary to ensure compliance with required procedures.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

19427 **(EGG-M—38187) Nuclear data measurements of neutron-rich nuclides produced in fission using on-line isotope separation.** Greenwood, R.C.; Anderl, R.A.; Caffrey, A.J.; Cole, J.D.; Drigert, M.W.; Helmer, R.G.; Lee, M.A.; Reich, C.W.; Struttman, D.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-880546—46). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005198/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The fission process produces a wide range of neutron-rich nuclides far off the line of beta stability. Use of mass separation coupled on-line to a fission source has provided a new method for systematic study of the nuclear decay properties of these fission isotopes. In addition to their importance in studies of basic nuclear properties of neutron-rich nuclei fission products, because of their intimate link with energy production in fission reactors, occupy a unique position in the field of applied nuclear decay data. Interest in fission product decay data has increased markedly in recent years. In addition to their critical role in nuclear reactor technology (decay heat source term, environmental hazards, etc.), such data are necessary to allow refinement of nuclear models of very neutron-rich nuclides used in astrophysical calculations involving the rapid neutron-capture process (r-process) of elemental synthesis in stellar environments. In this paper, recent nuclear data measurement activities at the INEL pertinent to both fission reactor technology and to nuclear astrophysics are discussed. For these studies, ISOL facilities both at the INEL and BNL (TRISTAN) are used. At the INEL ISOL facility a systematic study of the gross nuclear decay properties of short-lived fission-product isotopes (i.e., ground-state half-lives, beta-decay energies and beta-strength functions) has been undertaken. At TRISTAN measurements of delayed-neutron energy spectra of those fission-product precursors most important to reactor technology are being made.

19428 (PER—164, pp 33-36) **Quality assurance of technetium-99m radiopharmaceuticals.** Forsyth, O.E. Aug 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705936/JAW. (CONF-8808197—).

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

The purpose of quality assurance in radiopharmacy is to ensure that only safe and effictive radiopharmaceuticals of uniform quality are administered in the prescribed dose. The safety and efficacy of radiopharmaceuticals must never be regarded as a static field of interest and it should be noted that it is an integral part of

quality assurance to replace, wherever possible, established radiopharmaceuticals by newer ones that give better information or cause a lower radiation dose to the patients. Technetium-99m radiopharmaceuticals comprise two components, viz. the technetium-99m generator and a chemical formulation supplied as a sterile kit, thus offering a unique challenge to quality assurance. Each component as well as the final product has to conform to high standards of safety, efficacy, purity, sterility and apyrogenicity. The yield and safety in radiation terms of the technetium-99m generator are related to the radionuclidic purity. Efficiency of imaging the site(s) of interest depends largely on the pH of the separate and combined components and the labelling efficiency of the final product as well as its radiochemical purity. Sterility and apyrogenicity are achieved by incorporating quality procedures into the total process of production and handling. Biodistribution tests on mice are conducted to ensure that sites of interest are imaged, and Limulus Amoebocyte Lysate tests establish apyrogenicity of the sterile kits.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 20292, 20374, 20674

19429 (INIS-mf—11350, pp 9-29) **Applications of self-shielded electron processors in industry 1987.** Nablo, S.V. (Energy Sciences Inc., Woburn, MA (USA)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780070/JAW. (CONF-8704366—).

From Seminar on industrial applications of electron beams; Dublin, Ireland (16 Apr 1987).

Many new applications of the selfshielded electron processor have emerged over the past 5 years which continue to demonstrate the advantages and practical problems associated with these efficient, compact energy sources. Many of these, such as for the curing of: binders for abrasive products, binders for magnetic media, binders for textile flocking, silicone coatings for release papers, etc., offer good prospects for growth but are thusfar in limited use. With this ever broadening base of process technology, the prospects remain 'bullish' for the expanded industrial use of these new energy sources. With their unrivalled process off-licences and high throughputs, improved appreciation of their advantageous economics assures expanded application in an increasingly energy/environmentally concerned world economy

19430 (INIS-mf—11350, pp 30-38) **Industrial applications of high energy electron accelerators.** Hook, A.R. (Viritech, Swindon (UK)). 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780070/JAW. (CONF-8704366—).

From Seminar on industrial applications of electron beams; Dublin, Ireland (16 Apr 1987).

The Industrial Processing accelerator competes with other processing techniques and although it may have a 'Space Age' image it will only be used by industry if it is economically viable. The area of application that is changing with the evolution of high energy medium power accelerator is the use for medical sterilisation as an alternative to gamma but the future application that is evolving slowly and that will use many kilo watts of electron power is food. The processing accelerator is here to stay and it will extend its application into even more diverse applications in the future than it has in the past.

19431 **(INIS-mf—11350) Industrial applications of electron beams.** (Nuclear Energy Board, Dublin (Ireland)). 1988. 88p. (CONF-8704366—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780070/JAW.

From Seminar on industrial applications of electron beams; Dublin, Ireland (16 Apr 1987).

This book contains the proceedings of the seminar on industrial applications of electronic beams held in Dublin, Ireland on April 16, 1987.

19432 (INIS-mf—11356, pp 126) **Transport and disposal of Cobalt-60 industrial irradiation sources.** Kunstadt, P. (AECL Radiochemical Company (Canada)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19433 (INIS-mf—11356, pp 180) **Renewed interest in municipal sludge irradiation in the United States.** Sivinski, J.S. (Radiation Technology Programs, Albuquerque (USA)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19434 (INIS-mf—11356, pp 201) **Contemporary progress and perspectives of waste irradiation processing.** Vacek, K. (Nuclear Research Institute, Rez (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19435 (INIS-mf—11356, pp 202) **Radiation processing applications in the Czechoslovak water treatment technologies.** Vacek, K.; Pastuszek, F.; Sedlacek, M. (Nuclear Research Institute, Rez (Czechoslovakia); Water Resources, Prague (Czechoslovakia); Water Research Institute, Prague (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19436 **(LA-UR—89-488) Cold moderators for spallation sources.** Lucas, A.T.; Robinson, H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 22p. (CONF-8810182—22). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007979/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

Moderators using liquid and solid methane and liquid hydrogen are currently in use at major spallation neutron sources. Los Alamos Neutron Scattering Center (LANSCE) is planning the use of liquid methane as part of a major update program planned in about three years time. This report presents a general overview of some of these devices and outlines the general engineering design of the proposed LANSCE moderator, including some suggested solutions to the radiation damage problems of methane. Also included is a brief overview of a possible combined H_2/Ch_4 moderator for high intensity proton beams. 15 figs.

19437 **(LA-UR—89-581) Combined H_2/CH_4 cold moderator for a short pulse neutron source.** Williamson, K.D.; Lucas, A.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8810182—21). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007995/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

Very low temperature methane would be an ideal moderating material as it has a high hydrogen density and many low frequency modes which facilitate thermalization. Such moderators are in service at two major world facilities, KEK (Japan) and Argonne National Laboratory (USA). Unfortunately solid methane has very low thermal conductivity and is subject to radiation damage making a moderator of this type impractical for use in high intensity beam. This report outlines a possible alternative using small spheres of solid methane in a matrix of supercritical hydrogen at 25 K. 4 figs.

0703 Isotopic Power Supplies

19438 **(CTA-IEAv-RI—01/86) Possibility of the use of / sup 210/Po as heat source.** Passaro, A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). May 1986. 16p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705427/JAW.

The rate of production of /sup 210/Po was calculated for the reaction /sup 209/Bi (n,γ) /sup 210/Bi->/sup 210/Po by the β/sup -/ radioactive decay. It was estimated that 1 gr of bismuth, subjected to irradiation by thermal neutron flux of 10/sup 13/ n/cm/sup 2//s during a period of 420 days, produces 2.9 μg of polonium, that can generate 0.4 mW/sub th/.

19439 **(DOE/ET/32043—T26-Vol.2) Final safety analysis report for the Galileo Mission: Volume 2: Summary.** (General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center). 15 Dec 1988. Contract AC01-79ET32043. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007269/JAW.

The General Purpose Heat Source Radioisotope Thermoelectric Generator (GPHS-RTG) will be used as the prime source of electric power for the spacecraft on the Galileo mission. The use of radioactive material in these missions necessitates evaluations of the radiological risks that may be encountered by launch complex personnel and by the Earth's general population resulting from postulated malfunctions or failures occurring in the mission operations. The purpose of the Final Safety Analysis Report (FSAR) is to present the analyses and results of the latest evaluation of the nuclear safety potential of the GPHS-RTG as employed in the Galileo mission. This evaluation is an extension of earlier work that addressed the planned 1986 launch using the Space Shuttle Vehicle with the Centaur as the upper stage. This extended evaluation represents the launch by the Space Shuttle/IUS vehicle. The IUS stage has been selected as the vehicle to be used to boost the Galileo spacecraft into the Earth escape trajectory after the parking orbit is attained.

19440 **(N—89-13492) Power considerations for an early manned Mars mission utilizing the space station.** Valgora, M.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. 15p. (NASA-TM—101436; E—4472; NAS—1.15:101436; CONF-8707205—). NTIS, PC A03/MF A01.

From Case for Mars 3 conference; Boulder, CO, USA (18 Jul 1987).

Power requirements and candidate electrical power sources were examined for the supporting space infrastructure for an early (2004) manned Mars mission. This two-year mission (60-day stay time) assumed a single six crew piloted vehicle with a Mars lander for four of the crew. The transportation vehicle was assumed to be a hydrogen/oxygen propulsion design with or without large aerobrakes and assembled and checked out on the LEO Space Station. The long transit time necessitated artificial gravity of the crew by rotating the crew compartments. This rotation complicates power source selection. Candidate power sources were examined for the Lander, Mars Orbiter, supporting Space Station, co-orbiting Propellant Storage Depot, and alternatively, a co-orbiting Propellant Generation (water electrolysis) Depot. Candidates considered were photovoltaics with regenerative fuel cells or batteries, solar dynamics, isotope dynamics, and nuclear power.

19441 **(DOE/ET/32043—T26-Vol.2-Bk.1) Final safety analysis report for the Galileo Mission: Volume 2: Book 1, Accident model document.** (General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center). 15 Dec 1988. Contract AC01-79ET32043. 130p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007270/JAW.

The Accident Model Document (AMD) is the second volume of the three volume Final Safety Analysis Report (FSAR) for the Galileo outer planetary space science mission. This mission employs Radioisotope Thermoelectric Generators (RTGs) as the prime electrical power sources for the spacecraft. Galileo will be launched into Earth orbit using the Space Shuttle and will use the Inertial Upper Stage (IUS) booster to place the spacecraft into an Earth escape trajectory. The RTG's employ silicon-germanium thermoelectric couples to produce electricity from the heat energy that results from the decay of the radioisotope fuel, Plutonium-238, used in the RTG heat source. The heat source configuration used in the RTG's is termed General Purpose Heat Source (GPHS), and the RTG's are designated GPHS-RTGs. The use of radioactive material in these missions necessitates evaluations of the radiological risks that may be encountered by launch complex personnel as well as by the Earth's general population resulting from postulated malfunctions or failures occurring in the mission operations. The FSAR presents the results of a rigorous safety assessment, including substantial analyses and testing, of the launch and deployment of the RTGs for the Galileo mission. This AMD is a summary of the potential accident and failure sequences which might result in fuel release, the analysis and testing methods employed, and the predicted source terms. Each source term consists of a quantity of fuel released, the location of release and the physical characteristics of the fuel released. Each source term has an associated probability of occurrence. 27 figs., 11 tabs.

08 HYDROGEN

19442 **(TU/ME—8205) Program plan for the Institute For Hydrogen and Electrochemical Systems. Final report.** Scott, D.S. (Toronto Univ., Ontario (Canada). Dept. of Mechanical Engineering). 1982. 147p. (CE—02338). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A detailed proposal is presented for the establishment in Ontario of a nonprofit research institute, associated with the University of Toronto, whose objectives are to be: to ensure a technological and industrial readiness for the appropriate implementation of hydrogen technologies within Canada's energy mosaic; and to promote public awareness of evolving energy technologies and systems and their possible roles in Canada's future. Particular objectives are to conduct and promote systems analysis, research, development, demonstration and commercialization of hydrogen, electrochemical and energy systems together with their related technologies, and to provide public information on such systems. The proposal presents details on the Institute's corporate structure, management, staffing, accommodation, budget, and administration. In addition, proposed research programs are described under the various divisions: electrochemical technologies (fuel cells, water electrolysis, storage batteries); thermochemical technologies (liquid hydrogen storage and handling, magnetocalorific refrigeration, hydrogen combustion and engines); systems analysis; information services; and applications development (including a fuel cell powertrain program). 6 figs., 12 tabs.

0801 Production

REFER ALSO TO CITATION(S) 19183

19443 **(AIST—8803) Japan sunshine project 1987 annual summary of Hydrogen energy R and D.** (Agency of Industrial Science and Technology, Tokyo (Japan)). Apr 1988. 62p. (In Japanese). NTIS (US Sales Only), PC A04. Order Number DE88756450/JAW.

This paper presents the findings of the researches on hydrogen energy in sunshine project in FY 1987. A duration test of the electrolyte membrane of solid polymer fabricated by bonding Pt and Ir catalyst layers was made for seven months to produce hydrogen by the electrolysis of water. The result indicates that the electrolysis will be able to be made at high current density. The sensitivity to stress corrosion cracking of stainless steel for electrolysis of water was evaluated. Since a thin film of stabilized zirconia fabricated by sintering at a temperature of 1500°C or higher is dense and conductive, it is a promising solid electrolyte. Since an inert phase to hydrogen is developed in a high-density metallic alloy for hydrogen storage produced by sintering and partially melting Mg_7Zn_3-Ni, it must be improved. A heating module of hydrogenated material monolithically coated on copper tube was investigated. The application of metallic alloy for hydrogen storage

to the hydrogen electrode is studied. A hydrogen-fueled prime mover system circulating an inert gas is being developed. Since the low alloy steel part is extremely embrittled by heating, the intergranular face of coarse crystal affected by the cycle of welding heat is a problem. (32 figs, 4 tabs)

19444 **(DOE/MC/22060—2649) Computer software for multicomponent bulk separation by pressure swing adsorption: Equilibrium, linear driving force and bidispersed pore diffusion models: Final report, Part 2.** Kapoor, A.; Yang, R.T. (State Univ. of New York, Buffalo (USA). Dept. of Chemical Engineering). Feb 1988. Contract AC21-85MC22060. 97p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000922/JAW.

Three mathematical models (Equilibrium, Linear Driving force and Bidispersed Pore Diffusion Models) were developed to simulate and predict the performance of binary and multicomponent pressure swing adsorption processes. These models are capable of simulating all steps of the PSA cycle and predicting the effects of different process variables on the separation performance. Input data required by the models are equilibrium adsorption isotherms, and kinetic or diffusion data. Two FORTRAN programs were developed to simulate a PSA process for multicomponent bulk separation. In the subsequent sections, production of hydrogen from a coal gasification mixture (a mixture of H_2, CH_4, CO, CO_2 and H_2S) using 5A zeolite is used as an example to explain the usage of the program. However, with slight modifications this software can be used for other PSA systems. 22 refs., 3 figs., 1 tab.

19445 **(SV-UP—1987-52) Investigation of electrolysers for production of hydrogen and oxygen gas for industrial furnaces and electrical preheaters for combustion air.** Austlid, O. (Swedish State Power Board, Vaellingby). 17 Jun 1987. 80p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757099/JAW.

The report contains a market research of hydro-electrolysers, prices and performance characteristics, and an investigation of the economy by using hydrogen, produced by hydro-electrolysis, as a substitute for petroleum gas in industrial furnaces at Metallverken, Vaesteraas. The oxygen contribution is investigated and even preheating of combustion air by electricity. For electrolysers of 300 Nm/sup 3/H/sub 2//h the hydrogen gas price will be about three times the price of electricity or higher. Fixed costs are approx. 50%, and more for smaller plants. Not even the capital costs can be paid by the value of the substituted petroleum gas. The oxygen can be used to enrich the combustion air, the combustion temperature will rise, and the capacity of the furnace will increase. The oxygen cost is marginal compared to investment in a new furnace or in reconstruction. Liquid oxygen is, however, produced more cheaply by Lindemachine than by compressing retaining gas from hydro-electrolysis. Preheating of combustion air will increase the furnace capacity in the same as oxygen enrichment. With an electrical preheater a low investment cost can be achieved, but the consumption of electricity becomes high, although only for limited periods, exactly when the capacity increase is required. The consumption of electricity and costs for this method are compared to the use of oxygen from hydro-electrolysis.

19446 **Catalytic photoassisted splitting of water into hydrogen and oxygen and the photoassisted reduction of N/sub 2/ with water to NH/sub 3/.** Somorjai, G.A.; Khader, M.M.; Vurens, G.H.; Salmeron, M. (Lawrence Berkeley Lab. and Dept. of Chemistry, Univ. of California, Berkeley, CA (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

Iron oxide has been used as a photocatalyst for the decomposition of water into hydrogen and oxygen and also for the reduction of nitrogen by water to from ammonia, while illuminated with visible light. The catalysts was used in the form of powders, pellets, and thin films prepared by sputtering. Both reactions were proven to be catalytic by detecting hydrogen in amounts that exceeded the total amount of iron in the catalyst. The preparation of the iron oxide is a crucial step to obtain a working catalysts. α-Fe/sub 2/O/sub 3/ powder needs to be reduced in hydrogen and water at 450°C followed by reoxidation in oxygen at temperatures between 300°C and 500°C. Mossbauer spectroscopy and x-ray diffraction studies revealed that this process produces other phases of iron oxide like the psinal phase Fe/sub 3/O/sub 4/ and γ-Fe/sub 2/O/sub 3/ compounds. The rate of hydrogen production was 40 mole/g catalyst/hour and the rate of ammonia production was four times less. The iron oxide catalyst which is active for water decomposition and for ammonia formation is also an active catalyst for the photodecomposition of ammonia. If ammonia gas is mixed with oxygen gas, no hydrogen from the ammonia decomposition was detected. The rate of the ammonia decomposition increases linearly with the light intensity.

0802 Storage

REFER ALSO TO CITATION(S) 19443

0803 Transport

REFER ALSO TO CITATION(S) 19443

0805 Safety

REFER ALSO TO CITATION(S) 19443

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 19443

19447 **(STUDSVIK-KS—88-1) Hydrogen fueled urban transportation system. A feasibility study.** Pernestaal, K. (Studsvik AB, Nykoeping (Sweden)). 28 Jan 1988. 121p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757089/JAW.

This report is a feasibility study of a hydrogen fueled urban transportation system. To give the study a realistic background, the system operated by Uppsalabuss AB has been used as a reference frame. Different systems have been investigated from technical and economical aspects. In the case of Uppsalabuss, gaseous hydrogen gives the lowest cost. The project is made as a part of IEAs Hydrogen Program, Task VIII. The project is supported by Energy Research Commission, Uppsalabuss and Swedish State Power Board. (With 41 refs.)

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 19476, 19861

19448 **(CONF-880603—1) The conversion of community-derived wastes to methane in a high-rate digester.** Biljetina, R.; Srivastava, V.J.; Punwani, D.V. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 17p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007156/JAW.

From 17. world gas conference; Washington, DC, USA (5 Jun 1988).

The Institute of Gas Technology (IGT) has been operating a 4.5-m^3, anaerobic solids-concentrating digester at the Walt Disney World Resort Complex in Lake Buena Vista, Florida, since January 1984. This digester development work is part of a larger effort that provides effective community waste treatment and disposal options while recovering a valuable methane resources from these wastes. Excellent conversions to methane have been obtained in the digester during 4 years of uninterrupted operation. Data were collected on wastes from experimental municipal wastewater treatment appli-

cations, that is, water hyacinths were harvested from secondary wastewater treatment channels and combined with sludge from primary clarifiers to maximize potential methane recoveries in the digester; wastes from agricultural operations, that is, sorghum was selected as a candidate because it represents both a potential energy crop, as well as a waste resource if only portions of the plant are converted after grain production; and wastes from municipal waste collection. Municipal solids waste (MSW) from a commercial resource recovery center was selected. 3 refs., 4 figs., 5 tabs.

19449 **(CR—978-413) Gas recovery & utilization from a municipal waste disposal site. Vol. 1.** (Conestoga - Rovers and Associates, Waterloo, Ontario (Canada)). 1979. 185p. (CE—02366). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this project was to evaluate and demonstrate technology for recovering and using gas from landfill sites. A well was installed at a municipal landfill in Saint Thomas, Ontario, along with a system to pump the gas from the well and utilize the gas to heat an on-site greenhouse. Numerous gas and pressure monitoring probes were placed radially from the gas well to measure the pressure distribution and methane concentrations within the landfill to determine the effects of the pumping on the landfill. A conventional forced-air gas furnace was used, with minor modifications, to heat the greenhouse over the winter of 1979. Both tomato plants and bedding plants were grown. Gas monitoring was also conducted at the greenhouse site. An economic analysis was performed to demonstrate the cost-effectiveness of using landfill gas as an energy source for large-scale use in Ontario greenhouses, and some alternate uses for the gas are discussed. It is concluded that the recovery of landfill-generated methane is both feasible and economical. Larger quantities of gas can be extracted during the winter months when it is most needed. It is also concluded that it is possible to utilize landfill gas in an untreated form, that such gas is a reliable fuel source, and that a significant variation in gas concentration does not significantly affect the operation of a gas furnace. 21 refs., 53 figs., 13 tabs.

19450 **(DOE/ER/13731—T2) Structure and regulation of methanogen genes: Progress report, March 1, 1988--February 15, 1989.** Reeve, J.N. (Ohio State Univ., Columbus (USA). Dept. of Microbiology). 1989. Contract FG02-87ER13731. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008268/JAW.

The goals of this project were initially to obtain the primary structures of several cloned methanogen genes and subsequently to determine the mechanism(s) by which these genes are transcribed and how their expression is regulated. Studies have focused on both housekeeping genes encoding enzymes involved in the biosynthesis of amino acids (hisA, hisI, argG) and purines (purE) and on methane genes (mcrBDCGA; mvhDGAB) which encode enzymes (methyl coenzyme M reductase, methyl viologen-reducing hydrogenase) directly involved in the biosynthesis of methane. DNA-dependent-RNA-polymerases (RNAPs) have been purified from Methanococcus vannielii and Methanobacterium thermoautotrophicum and used in DNA-binding and footprinting studies to identify promoter sequences. Sites of transcription initiation in vivo have been shown to correlate well with the sites identified in vitro as RNAP binding sites. The mcr and mvh gene clusters contain open-reading frames (ORFs) which presumably encode polypeptides important in methyl reduction (mcrD and mcrC) and hydrogenase (mvhB) activity, which have yet to be identified in methanogenic cells. The mvhB gene appears to encode a new type of electron-transport protein, a poly-ferredoxin. 18 refs., 1 fig.

19451 **(STU—83-3977) Isolation and characterizing of an ammonium tolerant methane bacterium for the biogas process.** Mathisen, B.; Herrmann, B.; Ljunggren, H.; Virgin, I. (Swedish Univ. of Agricultural Sciences, Uppsala (SE). Dept. of Microbiology). (Swedish National Board for Technical Development, Stockholm). 27 Feb 1987. 13p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757082/JAW.

The purpose of the project was to isolate and study methane bacteria which are efficient at a high percentage of ammonium in a substrate and to test these bacteria for biogas processes in a laboratory scale. Three types of methane bacteria were isolated, one of which was further studied and found to be ammonium tolerant. This bacterium was inoculated to a laboratory digestor which produced gas in a normal scale when digesting pig manure. Applied on a large scale this type of inoculation would have a considerable importance for treating slaughter house waste and carcasses. (L.F.).

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 19476, 19861

19452 **(DOE/PC/70021—9) Direct synthesis of 2-methyl-1-propanol/methanol fuels and feedstocks: Quarterly technical progress report, December 1986--February 1987.** Klier, K.; Herman, R.G.; Simmons, G.W.; Bogdan, C.E. (Lehigh Univ., Bethlehem, PA (USA)). Nov 1987. Contract AC22-84PC70021. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008265/JAW.

The extended stability tests of the 0.4 mol% cesium formate promoted copper-zinc oxide catalyst have been performed under synthesis conditions predicted by the five parameter kinetic model as previously reported. An initial test of 500 hours in duration showed sustained activity and selectivity up to 250 hours after which changes in selectivity were followed by deactivation. A repeat test has shown that the absence of adequate, new charcoal traps causes the same selectivity changes and deactivation to occur from start of testing. Complete analysis of the catalysts after testing has been performed to determine the cause of the selectivity changes and deactivation. Results indicate that the cause of the problems is related to iron contamination. Iron deposition on the catalyst surface leads to Fischer-Tropsch centers that form waxes under the present reaction conditions and block the active sites for C_1-C_4 alcohol synthesis. 14 figs., 4 tabs.

19453 **(DOE/PC/70021—T1-Rev.1) Direct synthesis of 2-methyl-1-propanol/methanol fuels and feedstocks: Final technial report, September 15, 1984--January 14, 1988: Revision 1.** Klier, K.; Herman, R.G.; Simmons, G.W.; Nunan, J.G.; Smith, K.J.; Bogdan, C.E.; Himelfarb, P.B. (Lehigh Univ., Bethlehem, PA (USA)). Aug 1988. Contract AC22-84PC70021. 305p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003390/JAW.

The preparation of alkali (particularly Cs) promoted Cu/ZnO and Cu/ZnO/M_2O_3 (where M = Al, Cr, or Ga) catalysts has been optimized and the reaction conditions for the production of methanol and of C_2-C_4 alcohols, especially the branched 2-methyl-1-propanol product, have been optimized with respect to yields and selectivities. A five parameter kinetic reaction network has been developed for the synthesis of oxygenates from synthesis gas over the Cs promoted catalysts. The model successfully describes the 16-compound alcohol and ester product distribution obtained for a range of operating conditions and has been used for predicting the conditions required to attain specified 2-methyl-1-propanol/methanol selectivities and yields. The temperature dependence and apparent activation energy were determined for each of the model parameters, which allows the prediction of the product composition in a wide range of process conditions. Additional studies, in which ^{13}C labeled alcohols have been added to the feed gas, show that the distribution of the ^{13}C in the product alcohols and esters is consistent with the proposed reaction paths of the kinetic network. 77 refs., 83 figs., 48 tabs.

19454 **(IMR—8001) Feasibility of establishing potato ethanol plants on Prince Edward Island.** Hall, E. (Institute of Man and Resources, Ottawa, Ontario (Canada)). 1980. 23p. (CE—02387). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study was undertaken to assess the amount of the main agricultural waste in Prince Edward Island, namely, potato cullage and potato residue from processing plants, and to determine if their conversion to ethanol is practical in regard to both economic feasibility and net energy gain. It is estimated that there were enough culls produced to make a maximum of ca 1.9 million gal/y of etha-

nol. Processing plant residues may add to the total crop that could be converted. However, culls are normally available from September to June, with significant supply variation possible from month to month; this would mean that an ethanol plant would need warehousing facilities to be assured of a steady feedstock supply. Present fate of culls and processing waste includes use as cattle feed, thus indicating some competition in the market for potato wastes. Suitable energy sources for ethanol manufacture are examined; for the Island, the best appears to be wood, of which there is sufficient supply. Cost estimates are developed for large and small ethanol plants, and the market potential for the ethanol product is analyzed. It is concluded that large plants are not feasible due to insufficient feedstock; intermediate size plants (producing up to 3 million gal/y) may be feasible in certain areas of the Island, but the high cost of the product and lack of a market make this unlikely unless conditions improve. The small on-farm plant is currently the most feasible type of operation. Using the farm's culls as feedstock and the farm's wood for the energy source, the stillage could be used as animal feed and the ethanol as a gasoline substitute in farm equipment. 36 refs., 1 tab.

19455 **The logic of methanol.** O'Hare, T.E.; Sapienza, R.S.; Mahajan, D.; Skaperdas, G.T. (Brookhaven National Lab., Upton, NY (US)). pp v of Proceedings of the fifth annual international Pittsburgh coal conference. Pittsburgh, PA; University of Pittsburgh (1988). (CONF-880915—).

From 5. annual international Pittsburgh coal conference; Pittsburgh, PA, USA (12 Sep 1988).

Important sources of natural gas are situated far from markets, and a significant commercial activity has grown up based on liquefying natural gas at the source. The liquefied natural gas (LNG) is transported in specially designed LNG tankers to distribution ports equipped with LNG vaporization facilities which then deliver the vaporized gas into a pipeline system for distribution to users.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 19476, 19481, 19498, 20321

19456 **(AC/EAP—8304) Crop residue energy production systems: economic analysis and research priorities.** Nemetz, T. (Agriculture Canada, Ottawa, Ontario. Energy Analysis and Policy Div.). 1983. 22p. (CE—02373). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this paper is to examine the factors which affect the feasibility of utilization, in Canada, of crop residues for energy production. Discussion is conducted from an economic viewpoint. Only two processes for energy conversion technologies are considered, direct combustion and gasification, as these offer near-term application. In evaluating these process, the factors that must be considered are feedstock costs, equipment costs, and operating costs. Two theoretical systems are evaluated: a crop residue combustion system using a firebrick unit with heat exchanger, with wheat straw as feedstock; and a fixed-bed downdraft gasifier, with three possible feedstocks (corn cobs, wheat straw and cereal chaff). It is seen that both combustion and gasification seem to offer short and medium term possibilities for utilizing crop residues as an energy source. Applications will tend to be farm-scale due to the nature of the feedstock and will only be economical for operations which can fully utilize the type of energy produced. Feedstock costs represent the larger cost factor per unit of energy produced, for residues containing significant amounts of nutrients, and for which a separate collection process is required. Preprocessing reduces the economic viability of using crop residues. Labor is another important factor, and it is suggested that efforts be concentrated on developing systems having minimum labor requirements, thus limiting the impact of the system on the farm labor pool at times of labor demand. Gasification is suggested as the priority area for further research and development. 3 refs., 8 tabs.

19457 **(AFME-FR—1) Evaluation and prospects of the brushwood clearing in mediterranean area.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1985. 47p. (In French). (CONF-8511347—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756978/JAW.

From Technical workshop on "Evaluation and prospects of the Brushwood clearing in mediterranean area"; Sophia-Antipolis, France (25 Nov 1985).

New valorization methods for non-cultivated zones in mediterranean regions are presented (wood products, animal breeding ...); the utilization of biomass (plantations or residues) in heating plants is then examined; the third part of the seminar is concerned with harvesting machines for brushwoods, scrubs and small woods. Different scrubs and small woods utilization and combustion systems are described: house heating, small centers heating, industry heating, etc.

19458 **(DOE/OR/21389—14) Using recycled wood waste as a fuel in the northeast: A handbook for prospective urban wood waste producers, suppliers and consumers.** Prast, W.G.; Donovan, C.T. (Biomass Energy Service Team, Green's Farms, CT (USA); Biomass Energy Service Team, Falmouth, ME (USA); Biomass Energy Service Team, Stowe, VT (USA)). Mar 1988. Contract FG05-83OR21389. 185p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007195/JAW.

This report provides a comprehensive analysis of existing and future markets for recycled wood wastes in the eleven-state northeast region. The purpose of the report is to estimate the availability of wood and woody materials in the solid waste stream and to determine the technical and economic viability of separating and recycling them for other uses. The topics discussed include: current and future markets for recycled wood wastes; key components of successful wood waste processing facilities; decisionmaking process used to determine technical and economic viability of a proposed processing facility; environmental regulations and the permitting process required for recycled wood waste processors and users; case studies and annotated listings of existing wood waste processors and uses; detailed assessments of market opportunities in three metropolitan areas including Boston, New York, and Philadelphia; and a proposed action plan to stimulate and facilitate future market development.

19459 **(DOE/OR/21389—15) Northeast Regional Biomass Energy Program: Quarterly report, October 1988--December 1988.** O'Connell, R. (Coalition of Northeast Governors, Washington, DC (USA)). Jan 1989. Contract FG05-83OR21389. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007369/JAW.

This abstract has three basic features: (1) a state grant component that provides funds (with a 50 percent matching requirement) to each of the states in the region to strengthen and integrate the work of state agencies involved in biomass energy; (2) a series of technical reports and studies in areas that have been identified as being of critical importance to the development of biomass energy in the region; and, (3) a continuous long range planning component with heavy private sector involvement that helps to identify activities necessary to spur greater development and use of biomass energy in the Northeast. The state grant program provides states with an opportunity to strengthen and integrate the work of energy, forestry, air quality and other appropriate offices in promoting biomass energy use. Until recently, most state efforts to promote biomass energy have been fragmented among a wide range of agencies involved in various aspects of this energy source. The state grant projects require interagency cooperation and fall into several general categories: industrial conversion assistance; resource availability and use assessments; technical information development and dissemination; and conversion of state facilities.

19460 (IEACG—84) Residential wood burning in Canada. A digest of results from the National Study of the Viability of Using Wood for Domestic Heating. (IEA Consulting Group Ltd., Charlottetown, Prince Edward Island (Canada)). [1984]. 29p. (CE—02368). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In order to develop a comprehensive view of residential wood burning in Canada, telephone surveys and personal interviews were conducted across Canada. Primary wood burners (those providing 50% or more of their space heat from wood), secondary burners (those providing up to 50%) and other burners (those burning wood for recreational or aesthetic purposes) were included. This report presents highlights of data collected in these surveys. Information is given on the numbers of households burning wood, wood consumption, the amount of energy from conventional fuels that is displaced by primary and secondary wood burners and the financial savings achieved, characteristics of wood burners in different regions and owning different types of equipment, the behavior of wood burners (including the purchase of equipment and wood, and the operation of wood burning appliances), and the viability of wood burning in Canada. 1 fig., 18 tabs.

19461 (NGL—1983) Feasibility study for a model wood energy industry. (Neill and Gunter Ltd., Fredericton, New Brunswick (Canada)). 1983. 109p. (CE—02377). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A study was conducted of the possibilities for establishing a wood energy supply industry in New Brunswick. The study indicated that there are definite opportunities for the establishment of such an industry in the south-central region of that province. A financial analysis of five business models shows that three specific businesses are economically viable, namely, businesses for supplying wood chips, sawmill residues, and fuelwood. A review of the potential wood energy market in the target area (Kings and Queens counties) shows that there is a sufficient market for, and interest in, wood energy fuels so as to support either a wood chip or sawmill residue supply business plus a fuelwood supply business. Sales volume projections are based on replacing ca 11% of the existing petroleum products used for heating purposes in the area. Sales prices for the wood energy fuels which would provide attractive financial returns to the consumers have been used. The wood chip or sawmill residue supply businesses would sell their products mainly to industrial, agricultural and larger institutional consumers of petroleum products. There are adequate supplies of raw materials within the study area to support each of the businesses on a continuing basis. Five-year proforma profit statements have been prepared for each business model and the sensitivity of the models to changes in sales prices and volumes is analyzed. The economics favor the models which supply semi-processed wood fuels. Each of these businesses provides excellent returns on investment and has good margins of safety to accomodate reductions in sales prices and volumes. 16 refs., 12 figs., 57 tabs.

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 19932

1301 Resources And Availability

19462 (EC/IWD—1988) Surface water data, British Columbia. (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1988. 327p. (MICROLOG—88-05273). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented are the results of the hydrometric survey investigations for the 1987 calendar year which were made in the Yukon and Northwest Territories by the Water Survey of Canada. For gauging stations where a systematic record of water level or discharge was obtained, the following are given where available: a table of daily water level or discharge; a summary of monthly and annual data; and descriptive information about the gauging station and its site.

19463 (EC/IWD—1988) Surface water data, Manitoba. (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1988. 199p. (MICROLOG—88-05272). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented are the results of the hydrometric survey investigations for the 1987 calendar year which were made in the Yukon and Northwest Territories by the Water Survey of Canada. For gauging stations where a systematic record of water level or discharge was obtained, the following are given where available: a table of daily water level or discharge; a summary of monthly and annual data; and descriptive information about the gauging station and its site.

19464 (EC/IWD—1988) Surface water data, Saskatchewan. (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1988. 204p. (MICROLOG—88-05274). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented are the results of the hydrometric survey investigations for the 1987 calendar year which were made in the Yukon and Northwest Territories by the Water Survey of Canada. For gauging stations where a systematic record of water level or discharge was obtained, the following are given where available: a table of daily water level or discharge; a summary of monthly and annual data; and descriptive information about the gauging station and its site.

19465 (EC/IWD—1988) Surface water data, Yukon and Northwest Territories. (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1988. 123p. (MICROLOG—88-05281). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented are the results of the hydrometric survey investigations for the 1987 calendar year which were made in the Yukon and Northwest Territories by the Water Survey of Canada. For gauging stations where a systematic record of water level or discharge was obtained, the following are given where available: a table of daily water level or discharge; a summary of monthly and annual data; and descriptive information about the gauging station and its site.

19466 (EC/IWD—1988) Surface water data, Atlantic provinces. (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1988. 149p. (MICROLOG—88-05282). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented are the results of the hydrometric survey investigations for the 1987 calendar year which were made in Newfoundland and Labrador, New Brunswick, Nova Scotia and Prince Edward Island by the Water Survey of Canada. For gauging stations where a systematic record of water level or discharge was obtained, the following are given shere available: a table of daily water level or discharge; a summary of monthly and annual data; and descriptive information about the gauging station and its site.

19467 **(EC/IWD—1988) Surface water data, Alberta.** (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1987. 294p. (MICROLOG—88-05283). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3;MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented are the results of the hydrometric survey investigations for the 1987 calendar year which were made in Alberta by the Water Survey of Canada. For gauging stations where a systematic record of water level or discharge was obtained, the following are given where available: a table of daily water level or discharge; a summary of monthly and annual data; and descriptive information about the gauging station and its site.

19468 **(SV-UB—1987-48) New strategy for water level control at hydro power plants.** Fabricius, G.; Jensen, C.; Lindstroem, S.O.; Ottosson, T. (Swedish State Power Board, Vaellingby; ASEA Generation, Vaesteraas (SE)). (Swedish State Power Board, Vaellingby). 2 Dec 1987. 35p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757092/JAW.

This is the final report in a joint development project between Vattenfall (Swedish State Power Board, SSPB) and ASEA Generation. A new level control strategy has been developed, implemented and tested at the Bergeforsen hydro power plant reservoir, which is particularly difficult to control. The new idea is based both upon the results of prior tests with advanced controllers and on the experience of skilled operators controlling the plant. The controller has three modes of operation * Steady state mode at constant discharge or small discharge changes, * Transient mode at significant discharge changes, * Attentive mode in situations when the water level exceeds predefined limits. The main common feature is a human like control at every mode of operation. At transient mode the controller evaluates the performance and attempts to improve to the next period of operation. In steady state mode control actions are effectuated as rarely and exactly as possible. The tests show that it will be possible to design an operational controller with this technique. (authors).

1303 Plant Design And Operation

19469 **(NP—9770274) Bakun/Malaysia: Energy supply assurance on the basis of hydroelectric power generation.** (Deutsche Gesellschaft fuer Technische Zusammenarbeit G.m.b.H. (GTZ), Eschborn (Germany, F.R.)). 1988. 11p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770274/JAW.

The project agreement 'hydro electric scheme Sarawak' made on 1st December 1979 between the Federal German Government and the Malaysian Government expires at the end of the year. The project aim of this collaboration which has existed for more than nine years consisted in the entire planning to exploit the hydroelectric potential in Sarawak. The working results range from the general inspection of the electricity supply via detail studies to the documents concerning the calls for tenders. All planning results necessary for a technically feasible and economically meaningful decision to utilize the hydro-electric potential in Sarawak which is justifiable as far as the effects on the environment are concerned, will be presented to the Malaysian government as a recommendation.

1306 Environmental Aspects

19470 **(EPRI-GS—6246) Field testing of behavioral barriers for fish exclusion at cooling-water intake systems: Ontario Hydro Pickering Nuclear Generating Station: Final report.** McKinley, R.S.; Patrick, P.H.; Matousek, J.A.; Wells, A.W. (Electric Power Research Inst., Palo Alto, CA (USA); Ontario Hydro, Toronto (Canada); Lawler, Matusky and Skelly Engineers, Pearl River, NY (USA)). Mar 1989. 130p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

A field sampling program was conducted during the spring--summer of 1985 and 1986 at a test facility located offshore of Ontario Hydro's Pickering Nuclear Generating Station (NGS) on Lake Ontario. The objective of the field program was to evaluate the effectiveness of selected behavioral barriers for fish exclusion at generating facilities located on large freshwater lakes or impoundments. Three commercially available devices (air bubble curtain, pneumatic gun, and underwater strobe lights) were tested alone and in combination to determine their effectiveness in reducing impingement. Sampling was conducted at two identical structures with the behavioral barrier devices installed on one of the structures and the other structure acting as a control. The effectiveness of the devices at excluding alewife (the dominant local species) was determined by comparing net catches covering 2-h test periods between the two structures. All of the behavioral barrier devices or combinations of devices tested exhibited effectiveness index values greater than 50%. The greatest deterrent capability was associated with the pneumatic gun; the least with the air bubble curtain. Device combinations that included the pneumatic gun were generally less effective than the pneumatic gun alone. The underwater strobe light was only marginally effective at excluding alewife. The air bubble curtain and underwater strobe light combination was more effective than each device separately, but the results were variable. 48 refs., 41 figs., 21 tabs.

14 SOLAR ENERGY

19471 **(AIST—8805) Japan's sunshine project 1987 annual summary of solar energy R and D program.** (Agency of Industrial Science and Technology, Tokyo (Japan)). Apr 1988. 460p. (In Japanese). NTIS (US Sales Only), PC A20. Order Number DE88756452/JAW.

Results on Japanese sunshine project in 1987 are summerized as to fundamental research, development for practical use and international cooperation to utilize solar photo and thermal energy as follows: Solar photo-utilizing technology consists of the research of solar photo-voltatic power generating system(basic research, new type solar cell, amorphous silicon), and the practical utilization of solar photo-voltatic power generating system(lower cost silicon, solar panel, high efficiency crystal type solar cell, amorphous solar cell, solar cell evaluation system, peripheral technology, independent dispersive and centralized solar photo-voltatic power generating systems, photo and thermal hybrid solar photo-voltatic power generating system). Solar thermal utilizing technology consists of research of solar thermal and photo-voltatic power generating system(combined thermal-power solar system), solar air conditioning and hot water supplying system, and development of real industrial solar system. International cooperation means the solar energy technical cooperation project between Japan and Australia. (225 figs, 42 tabs, 2 photos)

1401 Resources And Availability

19472 **(INIS-BR—1432) Analysis of the temporal variation of radiation balance components in arid rice (Oryza sativa L.) culture.** Prates, J.E.; Coelho, D.T.; Steinmetz, S. (Vicosa Univ., MG (Brazil); Empresa Brasileira de Pesquisa Agropecuaria, Goiania, GO. Centro Nacional de Pesquisa de Arroz-Feijao). (Sociedade Brasileira de Meteorologia, Rio de Janeiro, RJ (Brazil)). 1988. 5p. (In Portuguese). (CONF-8811170—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705755/JAW.

From 5. Brazilian congress on meteorology; Rio de Janeiro, Brazil (7 Nov 1988).

The time variation of measured radiation balance components in a cultived rice area (Oryza sativa L.) under arid conditions in the Brazil central-west region was analysed. The relation between global solar radiation, radiation balance, reflected radiation and terrestrial effective radiation in three different stages of the culture development: vegetative stage; blooming and maturation, was determined. (M.C.K.).

1403 Economics

REFER ALSO TO CITATION(S) 19698

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 19171, 19446, 19451, 19454, 19456, 19457, 19505, 20554, 20669, 20721, 20730, 20750

19473 (AIST—8801) Japan's sunshine project 1987 annual summary of comprehensive research. (Agency of Industrial Science and Technology, Tokyo (Japan)). Apr 1988. 154p. (In Japanese). NTIS (US Sales Only), PC A08. Order Number DE88756448/JAW.

Basic design of the 1 kW class oceanic temperature difference power generation system was in progress. Test models were constructed and tested for the evaporator and absorption mixing condensation heat exchanger. Basic researches were conducted on the effect of water intake and discharge behavior on the elements of oceanic temperature difference power generation system. Deep sea anchorage was also investigated. Tasks for practical system and component technology were examined for 10 MW class. A 1/15 scale model was built for joining parts of water intake pipe and floating body to establish their functions. Researches on thermoelectric elements are concurrently going on using a 30 W class thermoelectric generation based on oceanic temperature difference. Researches conducted in the fields of biomass energy included: solar energy conversion in living organism; and production of liquid fuel from wooden biomass. Element technology in the 1000 kW class wind power generation, e.g. rotor and tower were conducted. (60 figs, 19 tabs, 6 photos, 31 refs)

19474 (CFS/GLFRC—8104) Biomass inventory of tolerant hardwoods in Algoma, Ontario. Thomas, J.B. (Canadian Forestry Service, Sault Ste. Marie, ON (Canada). Great Lakes Forest Research Centre). 1981. 85p. (CE—02417). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report summarizes the results of two related studies. The first study required the development of weight/diameter data for hard maple, yellow birch, seven other hardwoods, and six coniferous species in Northern Ontario. Non-linear regression equations were derived and tables of weights for green and dry weights of trees ranging from 2.6 to 100 cm breast height diameter were calculated by components. For the two major species, hard maple and yellow birch, weight/diameter equations were developed for total trees and for stem wood, stem bark, stem total, branches >2 cm in diameter, branches <2 cm in diameter, foliage, stump wood, stump bark, roots >2 cm in diameter, roots <2 cm in diameter, and for various sub-totals of these components. For the other less important hardwood species, and for the coniferous species, weight/diameter equations were developed for the above-ground components only. Weights of shrubs and saplings less than 1.26 cm were calculated also in two groups, hardwoods and softwoods. On the basis of point sampling, stand tables were prepared for each of the 83 stands in the study area. In the second study, the stand tables were combined with the weight/diameter tables to produce biomass estimates, by components, for each stand. These estimates were compared with cubic foot volume estimates for the same stands, to determine the degree of relationship between a biomass inventory and a conventional volume inventory of the same area. 5 refs., 5 figs., 45 tabs.

19475 (CONF-871269—4) Operation of an experimental test unit for the bioconversion of waste and biomass to methane. Biljetina, R. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 15p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007167/JAW.

From Anaerobic digestion program review meeting; Golden, CO, USA (1 Dec 1987).

The data collected at the experimental test unit (ETU) for three different feed materials indicate that an unmixed, solids concentrating (SOLCON) digester consistently outperforms a conventional Continuous Stirred Tank Reactor (CSTR), operating on feed slurries containing 5 to 10 weight percent solids. Methane yields have exceeded a CSTR digester in all cases by 10% to 50%. This type of digestion system is also extremely stable and flexible. Over 3-1/2 years of uninterrupted operation have been logged in the digester. During that time feedstocks, loading rates, and temperatures were changed without the need to reinoculate a "stuck" digester. Transition periods for different feedstocks and loading rates have been very smooth. Even the transition from mesophilic to thermophilic was uneventful. However, transitions from thermophilic operation back to mesophilic operation will require longer periods and special operating techniques to avoid a "stuck" digester. Following the operating campaign on sorghum, the digester culture was transferred for 1 day to a holding tank to allow inspection of the digester. Despite the unmixed operation, no unusual solids accumulations or "dead zones" were observed. All internals were in excellent condition. 3 refs., 4 figs., 7 tabs.

19476 (CONF-880932—6) The US biofuels industry. Klass, D.L. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 39p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007157/JAW.

From International renewable energy conference; Honolulu, HI, USA (18 Sep 1988).

The biofuels industry is made up of several unrelated industries and components of non-biofuels industries. It is disaggregated, small to moderate in size, and widely dispersed. At the present time, few biofuels technologies are in commercial use, and with two possible exceptions, no biomass species is grown in the United States specifically for conversion to biofuels. However, the commercial technologies still span the basic conversion processes of combustion, gasification, and liquefaction. Geographically, the biofuels industry is distributed over the entire nation; not one state is devoid of commercial biofuels production or utilization. The use of wood and wood waste as a fuel in the industrial and residential sectors is responsible for the largest portion of biofuels consumption, followed in order of decreasing contribution by municipal solid wastes, fuel ethanol, agricultural wastes, and biogas. Biofuels usage has slowly increased over the last several years because of environmental problems that need solutions, favorable legislation for some biofuels, and combinations of both. Despite some of the economic problems that temporarily confront the biofuels industry today, there are several business opportunities that are being developed at a relatively high rate. These projects include landfill gas recovery plants, municipal solid waste-to-energy systems, and small non-utility power generation plants that qualify for PURPA benefits. 48 refs., 21 tabs.

19477 (CONF-8804243—Summ.) Lignin research: Needs and opportunities. (USDOE Office of Energy Research, Washington, DC (USA). Energy Biosciences Div.). 1988. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008658/JAW.

From Workshop on lignin research: needs and opportunities; Urbana, IL, USA (18 Apr 1988).

A workshop held at the University of Illinois in April 1988 included representatives from many of the world's most active laboratories performing basic and applied studies relating to lignin. These participants discussed the current status of the various fields examining lignin, the directions for research on topics relating to lignin where more work is needed, and potential applications that lignin research may have in a commercial setting. 1 fig.

19478 (CONF-8809293—1) Recent progress in the gasification of biomass and wastes. Tarman, P.B. (Institute of Gas Technology, Chicago, IL (USA)). 28 Sep 1988. 9p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007160/JAW.

From Council meeting of the International Gas Union; Dresden, German D.R. (28 Sep 1988).

The recent natural gas bubble has caused a severe decline in the emphasis on the production of manufactured gas from fossil fuels. Most commercial activities have been abandoned, and many R&D efforts have been refocused from large-sale pilot and demonstration plants to small-scale laboratory efforts. Simultaneously, however, there has been a growing worldwide problem of waste

disposal. Severe penalty laws and the lack of available landfill sites in the United States and elsewhere have caused industry and municipalities to pay much more attention to their waste disposal methods. This has given rise to an increasing interest in burning and gasification as the safest way to dispose of wastes. As a result, many combustion facilities and several different gasification processes have emerged for the disposal of a wide variety of agricultural, industrial, and municipal solids wastes (MSW). 8 refs., 4 tabs.

19479 **(CRIE-U—87074) Upper limit rearing density of Japanese flounder paralichthys olivaceus, estimated by rearing experiments and oxygen consumption rates.** Honda, Haruo; Kikuchi, Kotaro; Saeki, Isao; Uemoto, Hiroaki; Kiyono, Michiyasu. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1988. 21p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756464/JAW.

In order to develop a circulation-filtration fish breeding system in which electricity is effectively used and advanced production control is performed, a study has been carried out. In this fish breeding system, the selection of the proper rearing density becomes very important factor for effective use of the limited water tank area and necessity to heighten the productivity. The rearing experiments were carried out to elucidate the upper limit rearing density for young flounder of 10g, 90-100g body weight. Furthermore, in order to investigate oxygen supplying method which is required in keeping the upper limit rearing density, oxygen consumptions of the flounder were measured under the various conditions. On the results obtained in the rearing experiments and the measurements of oxygen consumption, it is estimated that 3 to 4 times higher density rearing compared with the flounder culture doing now is possible in any growth process from fry to full-grown flounder, when the water quality control and the feed ingestion control are sustained at the optimum level. (10 figs, 2 tabs, 9 refs)

19480 **(DOE/ER/13620—T1) Particulate models of photosynthesis: Technical progress report, 1 September 1986--28 February 1989.** Seely, G.R. (Arizona State Univ., Tempe (USA). Dept. of Chemistry). Feb 1988. Contract FG02-86ER13620. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007961/JAW.

The objective of the research is to develop photochemical energy conversion model systems based on chlorophyll adsorbed to particles of polyethylene swollen with tetradecane. A number of amphiphiles derived from histamine have been synthesized, and tested with chlorophyll on polyethylene particles. They presumably ligate chlorophyll with the imidazole group, and some are capable of accepting electrons from the singlet excited state of the pigment. During the past year, the ability of chlorophyll to interact with cationic inverted micelles of dodecylpyridium iodide in toluene has been established, primarily by NMR chemical shift measurements. A presumption that a similar association exists within polyethylene-tetradecane particles has been supported, through mainly by indirect means. There is increased interest in nitroaromatic disulfides as potentially reversible oxidants for chlorophyll in the particulate system. One of them, 2,2'-dithiobis (5-nitropyridine), reacts with chlorophyll photochemically to form derivatives with reduced fluorescence, which appear to be covalently-linked donor-acceptor complexes. Experimental procedures have been tested for correcting fluorescence spectra and estimating quantum yields in highly scattering media, with the xanthene dye, 2'7'-dichlorofluorescein, in TiO_2 suspensions. Collaborative efforts in fluorescence determination and electrochemistry have continued. 40 refs., 10 figs., 2 tabs.

19481 **(ETSU-B—1158) Straw firing of industrial boilers.** (UKAEA Harwell Lab. Energy Technology Div.). 1988. 54p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The estimated surplus of straw in the United Kingdom is equivalent to about 1% of the UK energy requirement and is already being used to some extent as a cost effective fuel, particularly on farms. Danish technology and experience of using straw as a fuel on farms and in district heating boiler plants, is examined and the high capital costs noted. Factors influencing straw combustion have been investigated and trials of different straw samples, boilers and straw handling systems conducted. The market potential and overall economics of straw as a fuel in the UK have been considered. It is concluded that straw can, under certain circumstances, be an economically attractive alternative to other fuel in local commercial installations but each needs to be evaluated on an individual basis. (U.K.).

19482 **(FRCEA-TH—110) Experimental determination of the local order in hydrogenated amorphous silicon: neutrons diffusion and Exafs at the silicon K-threshold.** Menelle, A. (Paris-6 Univ., 75 (France)). 16 Jun 1987. 149p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756977/JAW.

A study of the local order in pure and hydrogenated amorphous silicon is presented. The role of hydrogen had been determined by means of neutronic diffusion measurements on cathode sputtered samples. By measuring Exafs on thin layers, it was possible to determine precisely the number of silicon first neighbours. It is shown that the silicon matrix is well described by a tetrahedric assembly with a large distribution of orientations. The hydrogen atoms are incorporated to the silicon essentially in SiH groups form.

19483 **(FRNC-TH—3394) Contribution to the polycrystalline silicon solar cells modelization.** Belkhaoua, A. (Institut National Polytechnique, 31 - Toulouse (France); Institut National des Sciences Appliquees (INSA), 31 - Toulouse (France)). 1986. 139p. (In French). NTIS (US Sales Only), PC A07. Order Number DE88756975/JAW.

A two-dimensional model for the description of the characteristics and performances of polycrystalline solar cells (P-N junction) is proposed: spectral response, open-circuit tension, short-circuit current, curve factor and conversion efficiency. The model is then extended to take into account the existence of vertical junctions in the cell thus allowing to analyze the effects of the new phenomenon called the "preferential doping" on the performances of the cell.

19484 **(HFS—8103) Biomass potential of aspen and white birch in Ontario.** Horton, K.W. (Horton Forestry Services Ltd., Stouffville, Ontario (Canada)). 1981. 36p. (CE—02421). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Over 12 million hectares of Ontario's productive forests contain aspen poplar and white birch in pure stands or mixed with conifers, and less than 10% of the annual allowable cut has been utilized. On the basis of biomass equations and yield tables developed in these studies, it is estimated that the annual growth of aspen and birch could supply up to 16% of the province's primary energy needs. Heavy concentrations are located in certain Boreal districts where biomass plants could be supplied in conjunction with established plywood, waferboard and pulpmill operations. The harnessing of biomass from aspen in particular, which grows much faster than major asseociated species and regenerates abundantly by root suckering, would incidentally solve pressing forest management concerns and greatly increase forest productivity as a whole. Silvicultural and management options for maximizing the potential are described. These options would fullfill both conventional needs and a biomass harvest. For optimal management, stands should be classified by physiographic site and clonal quality, but for interim practical purposes, the combined productivity classes resulting from this biomass yield study can be used as a framework for silvicultural prescription. More specific kinds of recommendations are given for different productivity classes of stands including predominantly aspen stands and predominantly coniferous mixedwood stands. 40 refs., 1 fig., 8 tabs.

19485 **(HFS—8103) Biomass yield tables for aspen in Ontario.** Horton, K.W. (Horton Forestry Services Ltd., Stouffville, Ontario (Canada)). 1981. 22p. (CE—02418). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Biomass growth and yield tables are presented for fully-stock, even-aged stands of post-fire or clearcutting origin of aspen

stands up to 90 years old in two forest regions of Ontario--the Boreal and the Great Lakes-St. Lawrence. Whole-tree biomass maximum mean annual increments range from 2.2 to 4.7 oven-dry tonnes per hectare per year, forming a plateau between ages 40 to 70 in the Boreal Region and 30 to 60 in the Great Lakes. Recommended biomass rotation ages are 40 and 30 respectively. Yields in the Boreal exceed those in the Great Lakes by from 18 to ca 30%. Stemwood ovendry mass constitutes 68-72% of above-ground, whole-tree mass. 7 refs., 5 figs., 6 tabs.

19486 (INIS-mf—11356, pp 189) **Chlorophyll mutations, induced by the combined effect of gamma-radiation and n-nitroso-n-ethylurea in phaseolus vulgaris (l.) savi.** Svetleva, D.; Petkova, S. (Higher Institute of Agriculture 'Vassil Kolarov', Plovdiv (Bulgaria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19487 (INIS-mf—11356, pp 52) **Radiation mutagenesis in the improvement of traditional microbial fermentation of Cassava.** Borisov, B.; Mukherjee, R.N. (International Atomic Energy Agency, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19488 (INIS-mf—11356, pp 65) **Two mutants of vine, resistant to downy mildew, obtained by Γ-irradiation of somatic material.** Coutinho, M.P. (Instituto Superior de Agronomia, Departamento de Botanico, Lisboa (Portugal)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

19489 **(LA-UR—89-103) Beneficial consequences of a selective glutamine synthetase inhibitor in oats and legumes.** Langston-Unkefer, P.J.; Knight, T.J.; Sengupta-Gopalan, C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 23p. (CONF-881267—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006523/JAW.

From Biological nitrogen fixations associated with rice production; Cuttack, India (28 Dec 1988).

We report on the effects of administering a unique glutamine synthetase inhibitor to cereals and N_2-fixing legumes. A bacterium (Pseudomonas syringae pv. tabaci) delivers this inhibitor to provide extended treatment periods; we inoculated the root systems of oat and legume plants with pv. tabaci to provide for delivery of this inhibitor to their root or root/nodule systems. Inoculation of legumes is accompanied by increased plant growth, total plant nitrogen, nodulation, and nitrogen fixation activity. Inoculation of the oats is accompanied by either of two results depending upon the genotype of the oat plant. One result is inhibition of plant growth followed by plant death as consequences of the loss of all of the glutamine synthetase activities in the plant and the subsequent accumulation of ammonia and cessation of nitrate uptake. The second and opposite result is observed in a small population of oats screened from a commercial cultivar and includes increased plant growth and leaf protein. The effects of this inhibitor can be beneficial when applied to appropriate plant material. In an attempt to effectively communicate these findings to the reader, we first introduce the inhibitor (a novel amino acid) and its bacterial delivery systems, the target of the inhibitor (glutamine synthetase-catalyzed ammonia assimilation), and the two different nitrogen economics in the legume and cereal plants used experimentally. The physiological, biochemical, and molecular genetic consequences of the inhibitor action in cereals and legumes, as we presently understand them, are then presented. 18 refs., 4 figs., 3 tabs.,

19490 **(NRRC—8010) Analysis of salvage yarding systems and costs in Pacific coast forests.** Nagle, G.S. (Nawitka Renewable Resource Consultants, Victoria, British Columbia (Canada)). 1980. 36p. (CE—02424). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A project was initiated in British Columbia to guide future development efforts in the logging of forest residuals. Objectives of the project were: to review available materials and industry experience on the extraction of coast forest residuals, with particular emphasis on the yarding or skidding phase, and with regard to productivity of equipment under different conditions; and to analyze this experience by updating cost estimates where possible, reviewing its relevance to the new energy harvesting possibilities, and outlining emergent needs for new equipment and systems for bringing forest residuals to roadside. This report reviews thirteen separate studies in detail, identifying major problem areas and defining the physical parameters of logging residues. Major problem areas identified were piece size and accessibility. A range of yarding costs were observed, from $5-70 per bone dry tonne, depending on utilization standards and accessibility. On the basis of the analysis done for this report, about 2 million bone dry tonnes per year are estimated to be available in the province, at a cost not exceeding $30/tonne at roadside. This represents ca 50% of available material. New technology will be required to be developed in order to harvest the remainder. 21 refs., 13 figs., 35 tabs.

19491 **(ORNL/Sub—84-89674/1) Cattail (Typha spp.) biomass production: Stand management and sustainable yields: Final report, 1984--1988.** Pratt, D.C.; Dubbe, D.R.; Garver, E.G.; Johnson, W.D. (Oak Ridge National Lab., TN (USA); Minnesota Univ., St. Paul (USA); Minnesota Univ., Crookston (USA)). Dec 1988. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007911/JAW.

Wetlands in the United States provide a large land base for producing biomass for energy applications. Typha species have been identified as a particularly suitable biomass crop for wetlands because of their superior productivity (40+ Mg/ha standing crops), pest resistance, adaptability, and chemical composition. Production methods were evaluated in this report to identify ways of maximizing biomass yields while minimizing costs, leading to a sustainable, economically competitive production system. Harvesting studies found that a single annual harvest of leaf biomass is preferable to a semiannual leaf harvest or an annual leaf harvest coupled with a biennial rhizome harvest. The annual leaf harvest is sustainable, results in the lowest nutrient removal, and yields 80% of the biomass obtained from the combined leaf/rhizome harvest. Semiannual leaf harvests appear to damage Typha stands and not be sustainable. Water loss from Typha stands, which will influence site selection and possible irrigation requirements, was found to be significantly affected by species selection, water management regimes, biomass yields, and microclimate. Based on equipment considerations, drainage of Typha paddies approximately one month prior to harvest is preferable to continuously flooded paddies even though yields appear to be reduced slightly. Studies of substrate pH limitations found that a pH range between 5.5 and 8.0 appears optimal. A flowering study found that while flowering can reduce vegetative shoot propagation and individual shoot standing crop, the frequency of flowering is usually too low to have an impact on overall yields, and, hence, control measures are unnecessary.

19492 **(ORNL/TM—10820) The SRWCP database management system: Users guide, data definitions, and source code.** Ehrenshaft, A.R.; Wright, L.L. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 129p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007915/JAW.

The Users Guide was written to facilitate access to the Short Rotation Woody Crops database which deals with the short rotation intensive culture of woody shrubs and trees. This manual presents some fundamentals about KnowledgeMan, the computer software that runs the system, provides definitions of the field variables, and contains the source code for the procedures which were

developed to adapt the KnowledgeMan software. The manual is organized in six sections. Section 1, Introduction, presents the rationale for the data management efforts. Section 2, Structure of the SRWCP Database Management System, describes the hardware and software requirements, the relational organization of the data, and the procedures developed to customize the KnowledgeMan software. Section 3 explains the use of the database through customized menus. Section 4 briefly illustrates some KnowledgeMan commands. Section 5 presents the source code for the procedures that control the SRWCP database management system and some of the more complex report-generating procedures. Section 6 contains the references used in developing the computer programs for SRWCP database management system. Appendix A lists the files used by the SRWCP database management system. Appendix B contains the data definitions (the Database Key), and Appendix C is a Data Table and Field Name Index. 3 refs., 11 figs., 5 tabs.

19493 **(ORNL/TM—10848) Short Rotation Woody Crops Program: Publications and presentations.** Ehrenshaft, A.R. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 94p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007905/JAW.

The Department of Energy's (DOE) Short Rotation Woody Crops Program (SRWCP) was initiated in 1978 with technical management and subcontract administration transferred to the Biomass Production Program of Oak Ridge National Laboratory (ORNL) in 1981. This bibliography was compiled to document the information dissemination activities of the researchers funded by the SRWCP. The following materials have been included: book chapters, papers published in conference proceedings, unpublished conference papers, unpublished seminars and talks, technical journal and mass media articles, proceedings and symposium abstracts, Forest Service technical reports, dissertations and theses, and unpublished draft reports (which may include final project reports to DOE). The publications and presentations are arranged into separate sections for each research institution and each section is arranged alphabetically by author. All the material attributable to one author, or group of authors is further sorted in descending chronological order. All the references are numbered sequentially. 1019 refs.

19494 **(PNFI—1980) Manual of data collection and processing for the development of forest biomass relationships.** Alemdag, I.S. (Institut Forestier National de Petawawa, Chalk River, Ontario (Canada)). 1980. 144p. (CE—02423). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes an attempt to develop a standard method of collecting field data on above-ground forest biomass, and processing these data in the laboratory, so that relationships may be established between the above-ground biomass of standing timber and conventional measurable variables. The report is intended to encourage uniformity in approach and in the expression of results, and is aimed specifically at participants in the Energy From the Forest program of the Canadian Forestry Service. The measurable independent variables to which ovendry biomass values will essentially be related are diameter at breast height, total height, age, site quality, density, and volume. In some studies photomeasured variables such as total height and crown area may also be included. The proposed data collection procedure is organized so as to provide data on developing single-tree mass functions, constructing mass yield tables, and converting volumetric inventory figures into mass. This manual covers both sample plot and sample tree measurements in the field, and the methods can be altered to meet local requirements. Selection of sample trees and the method of subsampling and weighing in the field are also explained, as well as laboratory methods. The data collected are intended to be recorded on Fortran coding forms, samples of which are included. Definitions, standards of measurements, lists of equipment, tree species codes, and a method for determining wood density are also provided. 3 figs.

19495 **(SAND—88-2577C) The potential of GaAs-based mechanically stacked, multijunction solar concentrator cells.** Gee, J.M.; Chiang, C.J.; King, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 7p. (CONF-890211—5). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007975/JAW.

From 4. international photovoltaic science and engineering conference; Sydney, Australia (14 Feb 1989).

The potential performance of GaAs-based mechanically stacked, multijunction (MSMJ) solar concentrator cells in 500X and 1000X concentrator modules are analyzed. The module operating temperature of MSMJ cells is higher than that of single-junction cells due to the stacked cell construction, which reduces the expected performance advantages of MSMJ versus single-junction cells. 12 refs., 2 figs., 2 tabs.

19496 **(SAND—88-3109C) Essential elements in the numerical modeling of solar cells.** Basore, P.A. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 9p. (CONF-890211—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008113/JAW.

From 4. international photovoltaic science and engineering conference; Sydney, Australia (14 Feb 1989).

The use of computer-based numerical device simulators to model high-performance solar cells is reviewed. The approximations necessary to convert the fundamental equations into a form that can be solved numerically are presented, with techniques for including multidimensional effects in a one-dimensional model. 10 refs., 2 figs.

19497 **(SAND—0381C) Progress in crystalline silicon research.** Arvizu, D.E.; King, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 10p. (CONF-890211—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007423/JAW.

From 4. international photovoltaic science and engineering conference; Sydney, Australia (14 Feb 1989).

This paper discusses progress in US sponsored crystalline silicon photovoltaic cell technology for one-sun and concentrating applications, from the research laboratory to the production line. A summary of field experience, present economics, projected utility requirements, cell efficiency status, and the US DOE research direction will be presented. 26 refs., 4 figs., 2 tabs.

19498 **(SLU-ISK—174) Handling characteristics of wood fuels. A literature review of the state-of-the-art and suitable measurement methods.** Mattsson, J.E. (Swedish Univ. of Agricultural Sciences, Garpenberg. Dept. of Operational Efficiency). 1988. 56p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757063/JAW.

This report summarizes findings from a literature review on the state-of-the-art and suitable methods to measure basic handling characteristics of comminuted wood. The search was concentrated to the international database CAB/PLANT and Forestry Abstracts. The angle of repose and of internal friction was reported to vary between 35 and 60 degrees and between 40 and 73 degrees respectively. The angle of sliding friction between particles and different wall materials (steel, aluminum plate, planed wood, glass, low friction polymer, rusty steel, concrete, rubber plywood along and crosswise the fibres, particle board and fire bricks) varies between 9 and 60 degrees. The main factors affecting the handling characteristics are particle shape, particle size, particle size distribution and moisture content. However, the literature gives no clear relation between these factors and the handling characteristics. Many authors stress the need to carefully study a new fuel rather than rely on general knowledge of other wood fuels. Conventional methods for calculating bridging in bulk solids over outlets are not applicable on wood fuels since the theories assume the material to be isotropic, plastic and a homogeneous continum. Therefore bridging in wood fuels should be studied in a way imitating the actual situation at a hopper outlet.

19499 (SV-US—1988-22) Feasibility study of biogas production from energy crops. Brolin, L.; Thyselius, L.; Johansson, M. (Swedish State Power Board, Vaellingby). 30 Apr 1988. 77p. (In Swedish). NTIS (US Sales Only), PC A05. Order Number DE88757101/JAW.

Sweden has a great need for alternatives to traditional agricultural cultivation. In many countries, there has over the past ten years been a great interest in biogas production from energy crops. Biogas may be used in many different ways: * Direct combustion for the production of heat or steam, * As a substitute for natural gas, * Engine fuel for vehicles, the generation of electric power and for heat pumps. The aim of this study was to investigate whether biogas production from energy crops could be profitable in Sweden. The feasibility study included a tentative plant design and cost estimation for a complete system from production of crops to the use of gas and residual products. The study included: * biogas plants with outputs from 0.5 MW to 4.0 MW, * five different crops, * different yields, where three different scenarios were studied: 1. current normal yield, 2. current best yield, 3. future yield. The production cost of biogas produced from specially grown agricultural crops is at least SEK 0.30-0.35/kWh. The biogas is about twice as expensive as oil and can not be sold on a commercial basis. Even with increased yields in the future, the cost of biogas will be too high. The costs for the digestion plant decrease with increased plant size. For biogas plants of 2-4 MW the plant cost is about SEK 0.10-0.15/kWh. This indicates that biogas can be produced on a commercial basis if the feedstock for gas production is free. This can be the case if: * residues and waste are used, * some other product from the crop is utilized and sold, e.g. protein, cellulose. (With 28 refs., 16 tables and 28 figs.) (authors).

19500 (VTT-SYMP—75) New alternatives for biomass conversion in the 1990s. Sipilae, K. (ed.). (Secretaria de Asentamientos Humanos y Obras Publicas, Mexico City (Mexico)). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1987. 124p. (In Finnish). (CONF-8610453—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757106/JAW.

From Seminar on new alternatives for biomass conversion in the 1990s; Helsinki, Finland (21 Oct 1986).

Significance of biomass for the chemical industry and obstacles to extending its use were discussed at the Seminar on New Alternatives for Biomass Conversion in the 1990s, held in Helsinki on October 21, 1986. New alternatives of wood and peat conversion were surveyed with regard to producing energy and chemicals. A peat ammonia factory, and fluid-bed gasification represent the latest conversion technology. Ventures under research are pressurized fluid-bed processes for electricity generation and hydrogenation and pyrolysis technologies. The Energy Department of the Ministry of Trade and Industry is a significant financer of these research projects. Research on peat and wood conversion is done especially at the Laboratory of Fuel Processing and Lubricant Technology of the Technical Research Centre of Finland.

19501 (VTT-SYMP—81) Biofuels and peat in the nordic energy economy in 2000. Kanervirta, M.L. (ed.). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1987. 129p. (In Swedish). (CONF-8708324—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757107/JAW.

From Seminar on biofuels and peat in the Nordic energy economy in 2000; Jyvaeskylae, Finland (4 Aug 1987).

The seminar /sup B/iobraenslen och torv i Nordens energiekonomi aar 2000/sup /(Biofuels and peat in Nordic energy economy in 2000) was held in Jyvaeskylae 4-5.8.1987. The meeting was on of three theme seminars associated with the main event /sup N/ordisk Traeff 1987/sup /(Nordic Meeting 1987). The seminar treated the status of biofuels and peat in the Nordic energy economy, surveyed the energy programmes in Denmark, Finland, Norway and Sweden and presented the latest techniques applied at commercial level. The main topic of the panel at the end of the seminar was development of Nordic co-operation in the peat and bioenergy field. The Danes have far-advanced straw technology and knowledge associated with burning of municipal waste; the Norwegians have knowledge associated with small scale use o wood; the Swedes can exploit chips and wood waste and peat; and the Finns have the knowledge and technology needed in burning of wooden fuels and particularly peat. Regular meeting of this kind were considered one way to improve information transfer. Cooperation should also be increased with the International Energy Agency (IEA), International Peat Society (IPS), the Swedish Peat Research Foundation and through organisations acting between the countries. It was found necessary to develop a uniform advisory system at Nordic level and possibly on the basis of the already existing organisations. Possible joint research project emerging were development of peat production methods usable throughout the year, standardisation the equipment technique and fuel types, combustion of waste, research into environmental releases, cost comparisons between the different countries, solutions to joint production of heat and electricity and application of the technology in the field to the developing countries. (Abstract Truncated)

19502 Fabrication of n^+/p InP solar cells on silicon substrates. Keavney, C.J.; Vernon, S.M.; Haven, V.E.; Wojtczuk, S.J.; Al-Jassim, M.M. (Spire Corporation, Patriots Park, Bedford, Massachusetts 01730). *Applied Physics Letters;* **54**: No. 12, 1139-1141(20 Mar 1989).

InP solar cells were fabricated from films deposited by metalorganic chemical vapor deposition on Si substrates (using a GaAs buffer layer) and on GaAs substrates. Air mass zero efficiencies of 7.1% and 9.4%, respectively, were achieved. Prospects are good for improving the material quality of the InP films, but more work is needed to make the n^+-p-p^+ structure of the InP solar cells compatible with the silicon substrates, which cause n-type doping of the III-V films.

19503 DNA clone encoding a photosystem I protein with homology to photosystem II chlorophyll a/b-binding polypeptides. Hoffman, N.E.; Pichersky, E.; Malik, V.S.; Castresana, C.; Ko, K.; Darr, S.C.; Cashmore, A.R. (Univ. of Pennsylvania, Philadelphia (USA)). *Proceedings of the National Academy of Sciences of the United States of America;* **84**: No. 24, 8844-8848(Dec 1987). Contract FG02-87ER13680.

The authors report here the isolation and nucleotide sequence of a complete cDNA clone encoding a photosystem I (PS I) polypeptide that is recognized by a monoclonal antibody made against photosystem II (PS II) chlorophyll a/b-binding (CAB) proteins. The deduced sequence of this PS I protein shows 30% overall identity to PS II CAB sequences, and two long segments within this protein show 50% and 65% identity to the corresponding segments in the PS II CAB polypeptides. Even though the sequence of this PS I CAB protein is substantially divergent from PS II CAB sequences, their hydropathy plots are very similar and suggest they all traverse the thylakoid membrane three times. A segment of the PS I CAB polypeptide shows similarity to the functionally analogous β subunits of the antenna proteins of purple bacteria. In contrast, no homology was observed between these bacterial proteins and PS II CAB polypeptides.

19504 Short circuit current losses in GaInP/sub 2/ top cells. Olson, J.M.; Kurtz, S.; Kibbler, A. (Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

The ternary alloy Ga/sub 0.5/In/sub 0.5/P (GaInP/sub 2/), with a band gap of 1.9 eV and a lattice constant equal to that of GaAs, is a novel and attractive top-cell material for a monolithic tandem photovoltaic device. The lattice match between the GaInP/sub 2/ and the underlying GaAs obviates the need for a lattice grading buffer layer, and should greatly simplify the growth of a high quality GaInP/sub 2/ top cell, compared to lattice mismatched systems. The cascade combination of GaINP/sub 2/ and GaAs homojunctions has maximum AM1.5 theoretical efficiency of 34% with a short circuit current density J/sub sc/ of 16.5 mA cm/sup -2/ (11 ma cm/sup -2/ without an antireflection coating.) The authors find, however, that the J/sub sc/ of the GaInP/sub 2//GaAs tandem cell is limited by the J/sub sc/ generated in the GaInP/sub 2/ top cell. Factors that affect the performance of the GaInP/sub 2/ homojunction are presented in this paper. The authors have found that the dopants also have a more-than-expected

effect on the photovoltaic quality of GaInP/sub 2/. At Zn concentrations of 10/sup 18/cm/sup -3/ or greater in the GaInP/sub 2/, the dopant source DEZ apparently catalyzes the adduct reaction between TMI and PH/sub 3/ leading to a loss of compositional control (generally In deficient), poor morphology, and low photovoltaic quality. At levels of 10/sup 17/cm/sup -3/, however the effects are negligible.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 19440

19505 **(EPRI-GS—6306) Survey of US line-connected photovoltaic systems.** Smith, K. (Electric Power Research Inst., Palo Alto, CA (USA)). Mar 1989. 46p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

Representatives from utilities and the photovoltaics industry were contacted in the summer of 1988 to assess the current state of line-connected photovoltaics in the United States. The original focus of this search was small residential PV systems, but all others were included for completeness. The result of this effort is a comprehensive listing of line-connected photovoltaic systems. Two hundred nineteen systems are listed, ranging in rating from 0.15 to 1000 kWe, and producing a total of 11,575 kWe peak power. First, the findings of the database are analyzed with respect to rating, number of systems, ownership, and date of installation. Next, the major technical problems reported with photovoltaic modules, inverters, and balance of system components are discussed. The issues of safety, module rating conditions, institutional barriers, and education are also addressed. Finally, the issues of line-connected photovoltaics are put in the perspective of the residential system owner. 16 refs., 13 figs.

19506 **(N—89-13829) Conceptual design of a lunar base solar power plant. Lunar base systems study task 3.3.** (Eagle Engineering, Inc., Houston, TX (USA)). Aug 1988. 60p. (NASA-CR—172086; NAS—1.26:172086; EEI—88-199). NTIS, PC A04/MF A01.

The best available concepts for a 100 kW Solar Lunar Power Plant based on static and dynamic conversion concepts have been examined. The two concepts which emerged for direct comparison yielded a difference in delivered mass of 35 MT, the mass equivalent of 1.4 lander payloads, in favor of the static concept. The technologies considered for the various elements are either state-of-the-art or near-term. Two photovoltaic cell concepts should receive high priority for development: i.e., amorphous silicon and indium phosphide cells. The amorphous silicon, because it can be made so light weight and rugged; and the indium phosphide, because it shows very high efficiency potential and is reportedly not degraded by radiation. Also the amorphous silicon cells may be mounted on flexible backing that may roll up much like a carpet for compact storage, delivery, and ease of deployment at the base. The fuel cell and electrolysis cell technology is quite well along for lunar base applications, and because both the Shuttle and the forthcoming Space Station incorporate these devices, the status quo will be maintained. Early development of emerging improvements should be implemented so that essential life verification test programs may commence.

19507 **(SAND—89-0332C) Photovoltaic systems for today's remote power applications.** Post, H.N.; Thomas, M.G.; Risser, V.V. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 7p. (CONF-890211—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007431/JAW.

From 4. international photovoltaic science and engineering conference; Sydney, Australia (14 Feb 1989).

The Design Assistance Center (DAC) has developed a database of design, performance, and operating experience for remote photovoltaic (PV) systems. The DAC uses this database to assist potential users in evaluating PV for their specific applications and to accelerate the acceptance of PV as a viable power option for remote applications. 12 refs., 1 fig., 1 tab.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 19440, 19567

19508 **(FRNC-TH—3392) Energy efficiency of solar central receiver plants (molten salt type).** Boutin, V. (Nice Univ., 06 (France)). 1986. 183p. (In French). NTIS (US Sales Only), PC A09. Order Number DE88756974/JAW.

The different energy losses of the THEMIS solar central receiver plant have been identified and quantified experimentally. The influences of meteorological variations are analyzed and the energy efficiency of the plant is modelized. Two important losses points were evaluated in details: the loop conduction losses and the conditioning losses. Two operating strategies for the secondary loop are studied: maintain the loop at high temperature during the shutdown, and let the loop cool off and heat it up again when the production is started again.

19509 **(FRNC-TH—3395) Study and implementation of a cylindrical solar furnace supplied with optical fibers.** Borie, P. (Toulouse-3 Univ., 31 (France)). 1986. 125p. (In French). . Order Number DE88756973/JAW.

A cylindrical solar furnace is described and tested; the solar energy is transferred in a radiative mode from the collectors to the receptor by means of optical fibers. A prototype module has been developed which is able to heat a 7 cm/sup 3/ volume up to 700 degrees C. The various heat transfers are analyzed and the receptor temperature evolution is modelized as a function of the receptor material characteristics. Experimental results are given.

19510 **Cost drivers for solar thermal central receiver power plants.** Brown, D.R. (Pacific Northwest Lab., Richland, WA (US)). *Journal of Solar Energy Engineering;* **110**: No. 2, 156(May 1988).

Studies completed at the Pacific Northwest Laboratory have allowed an in-depth examination of costs for solar thermal central receiver power plants. Central receiver concepts were evaluated for plant power ratings ranging from 0.5 to 100 MWe, and plant capacity factors ranging from 0.25 to 0.60. The large number of plant configurations considered necessitated the development of cost estimating models. Cost models were developed for concentrator, receiver, transport, storage, energy conversion, balance of plant, and O and M components. This paper presents a detailed discussion of costs for solar thermal central receiver power plants. Principal subcomponents and cost drivers are identified for each component. The impact of alternative design choices on cost and the tradeoffs involved between different working fluids are addressed. Cost uncertainties are examined qualitatively for each component. Finally, equations are presented for making preliminary estimates of direct capital and annual O and M costs for solar thermal central receiver systems.

1408 Ocean Energy Systems

REFER ALSO TO CITATION(S) 19473, 19527

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 19720, 19729

19511 **(A/ENR—NR119) Solar energy matters.** (Alberta Energy and Natural Resources, Edmonton (Canada)). 1979. 18p. (CE—02382). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document outlines the basic principles of the solar energy cycle, forms of solar energy available in Canada, and how solar energy utilization can be applied to housing, notably in Alberta. Such use of solar energy can be achieved by designing houses to minimize heat losses and to be properly oriented, making maximum use of landscape features. In addition, passive and active solar heating systems can be installed for space heating, hot water heating, and swimming pool heating. 3 refs., 12 figs.

19512 **(BOUWCENTRUM—11766) Passive use of solar energy in the public housing of Capelle aan den Ijssel, Netherlands. Measurements.** Straatman, J.T.; De Vries, G. (Bouwcentrum, Rotterdam (Netherlands)). Jul 1987. 76p. (In Dutch). Bouwcentrum BV, P.O. Box 299, 3000 AG Rotterdam, Netherlands.

The project as stated in the title is subdivided into 5 phases: preparation, design and building of the project, measurements and final report. This report presents the measurement method, results, energy consumption, a comparison with theoretical calculations and an evaluation of the test results. The project consists of eleven single family dwellings equipped with indirectly heated air heating systems combined with balanced ventilation and heat recovery from removed ventilation air. The air heater is connected to the district heating system. The sun parlours and front collectors are open systems to preheat supply of ventilation air from outside. 33 figs., 10 refs., 8 tabs., 8 apps.

19513 **(DOE/SF/16306—11) Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of January and February 1989.** Karaki, S. (Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.). 7 Mar 1989. Contract FG03-86SF16306. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007966/JAW.

This report discusses the testing and evaluation of solar space heating and cooling systems, solar water heater, and solar concentrators. (LSP)

19514 **(GB—165) Simple method for predicting the thermal performance of conservatories.** Baker, N.V. (Cambridge Univ. (GB) Dept. of Architecture). (Cambridge Univ. (UK). Dept. of Architecture). [1988]. 20p. NTIS (US Sales Only), PC A03. Order Number DE88755465/JAW.

A simple method for predicting the temperatures attained in a conservatory (or other unheated glazed space attached to a heated building) is described. The method also predicts the energy savings due to reduced conductive losses and ventilation preheating. The results of two typical applications are described.

19515 **(Juel—2047) Solar installations for water heating. Analytical studies of thermosyphons and pumps in Central European climate.** Scheller, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung; Technische Hochschule Aachen (Germany, F.R.)). Mar 1986. 144p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757161/JAW.

The subject of the investigation are solar hot water installations for the average hot water requirements of a one-familiy household. Systems with heat transformers and anti-freeze in the collector circuit and external auxiliary heating of hot water are treated. The crucial point lies in the more exact observation of the operational performance of thermosyphon plants. The thermal and hydraulic performance is described with the aid of two simulation models for pump and thermosyphon plants. By comparing measurement recording and computer results, the validity and computing accuracy of the models is demonstrated. From the parameter studies one can take suitable measurements for the construction of a powerful thermosyphon plant.

19516 **(TNO-TPD—714.008) An electric flow boiler used as an after-heater in solar boilers.** De Geus, A.C.; Schoonewille, H. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Sep 1987. 33p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

The feasibility of a boiler as stated in the title has been studied by the Institute of Applied Physics of TNO-TH, Netherlands, in cooperation with Holland Energy Systems, Zevenbergen, Netherlands. The flow boiler combines the advantages of the conventional boiler (minimal maintenance) and of a gas water heater (more or less unlimited hot water supply). A conventional electric boiler was used as a reference. The flow boiler combined with a solar boiler, or alone, is compared to the reference boiler to calculate the energy conservation. Some parameters like volume and temperature of the flow boiler are varied. The energy conservation is about 10% without the solar boiler and circa 55% in combination with the solar boiler. The financial savings depend strongly on the electric power prices, the distribution of cheap and expensive electricity and the costs of the solar boiler. It is to be expected that the flow boiler costs are comparable to the reference boiler. A prototype test of the flow boiler is needed to verify the technical and economical starting points. 4 figs., 2 refs., 7 tabs., 1 app.

19517 **Evaluation of hourly building energy programs for passive solar residential construction.** Sorrell, F.Y.; Vanhoy, G.A.; Childers, M.W.; Paulos, S.K. (Dept. of Mechanical and Aerospace Engineering, North Carolina State Univ., Raleigh, NC (US); North Carolina Alternative Energy Corp., Research Triangle Park, NC (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 588-599(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper 3089.

The accuracy of three computer programs, DOE-2.1b, TARP84, and EMPS 2.1, for predicting the hourly energy use of passive solar residential buildings was investigated. Measured energy use and interior space temperatures from passive solar test buildings were compared with the results obtained from computer analyses of those buildings. The data base was composed of available data from unoccupied buildings that had passive solar components and had detailed, accurate measurements over a well-defined test period. The results indicate that TARP84 and EMPS-2.1 can accurately model most passive solar features, whereas DOE-2.1b is not as accurate for some high mass structures. Structures with partial shading of the high mass component were more accurately modeled by TARPP84 and by EMPS-2.1 than by DOE-2.1b.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 19509, 19510

19518 **(SAND—89-0382C) Advances in concentrator cell technology.** King, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 9p. (CONF-890211—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007432/JAW.

From 4. international photovoltaic science and engineering conference; Sydney, Australia (14 Feb 1989).

The dramatic improvement in silicon concentrator cell efficiency recently demonstrated in university laboratories has had a significant influence on concentrator technology development. This paper briefly describes concentrator field experience, economics, current technology paths, and concludes with a detailed summary of concentrator cell performance. 29 refs., 2 figs., 3 tabs.

19519 (STU—85-5404, pp 97-102) **Accelerated testing of absorbers for flat plate solar collectors.** Wennerholm, H. (Swedish National Testing Institute, Boraas (SE)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

This study was performed to aid in the development of accelerated test methods needed for evaluation of absorber materials. Absorber materials included in the test program were black chrome, anodized aluminium, blue stainless steel, alkyd, acrylat, polyester, phtalimide, silicone and porcelain enamel. Substrates included steel, stainless steel, copper and aluminium. A single test specimen was used at each measurement point in the laboratory tests and in the outdoor exposures. In addition a number of complete collectors were exposed outdoors under stagnation. Absorptance and emissivity were measured before and after each test. Key degradation factors were identified as moisture, elevated temperature, sulphur dioxide and UV-radiation.

1420 Heat Storage

REFER ALSO TO CITATION(S) 19745, 20282

19520 **(BFR-R—79-1988) Determination of winter heating and the development of thermoclines in Tulebo lake.** Sahlberg, J. (SMHI, Norrkoeping (SE). Hydrologiska/Oceanografiska avd.). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 23p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757036/JAW.

Temperature measurements made over a period of 2-3 years in Tulebo lake have shown that heating of the lake in winter is dominated by solar radiation penetrating the ice. This is particularly the case when the ice is snow-free. The objective of this report is to develop and verify routines for measuring how solar radiation penetrates an ice cover, and how the effect of wind can be reduced in the case of small, protected lakes. The work is based on earlier work performed in the Arctic on the penetration of sunshine through sea ice, and on work in connection with reduction in wind stress in small lakes. The final result of the work is to confirm that the formulations developed for describing the ability of solar radiation to penetrate ice and the reduction in wind stress provide good descriptions of the measurments made in Tulebo lake.

19521 **(NEI-SE—32) Heat storage in clay by parish house at Soederkeoping. Geotechnical follow-up and evaluation.** Rydell, B.; Sundberg, J. (Statens Geotekniska Inst., Linkoeping (Sweden)). 19 Aug 1987. 18p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88757056/JAW.

Heat storage in clay was demonstrated without any obvious consequences with aspect to clay properties. As preconsolidation pressure is temperature dependent great precaution should be taken in location a heat store in normal or under consolidated clay. This holds in particular at high temperatues. Other important factors are use of ground and foundation-laying of surrounding buildings. Location of heat stores in a sloping ground should be avoided. (O.S.).

15 GEOTHERMAL ENERGY

19522 **(AIST—8804) Japan's sunshine project 1987 annual summary of geothermal energy R and D.** (Agency of Industrial Science and Technology, Tokyo (Japan)). Apr 1988. 198p. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88756451/JAW.

Results are reported on the geothermal energy research for 1987 in the Sunshine Project. Exploration methods and formation mechanism of fracture type reservoirs were studied together with the study of their productivity. Basic maps for regional resources evaluation were prepared for five regions in Japan and parameters were determined. Percussion drills and aerated mud excavation technique were developed. Damages in hydrothermal flow were investigated and materials were developed. Crushing and thermal extraction mechanism were analyzed by the pressurized water crushing experiments at a quarry. Results of field experiment on the hot rock mass were analyzed. Environmental conservation and multipurpose use of hot water were investigated. Wide area hydrothermal flow system was surveyed at three areas. High accuracy MT method was developed and its effectiveness was demonstrated. Data was compared and analyzed for the Sengan and Kurikoma areas, which differ in abundance to each other. For development of binary 10 MW class demonstration plant, a well was excavated and tested, downhole pumps were tested and improved, and the conceptual design was investigated for plant equipment. Researches were conducted on the production and recirculation mechanism of hot water and control of water flowout. (61 figs, 7 tabs)

1501 Resource Status And Assessment

19523 **(DOE/CH/10093—49) Geothermal energy program summary: Volume 1: Overview Fiscal Year 1988.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Geothermal Technology Div.). Feb 1989. Contract AC02-83CH10093. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000864/JAW.

Geothermal energy is a here-and-now technology for use with dry steam resources and high-quality hydrothermal liquids. These resources are supplying about 6% of all electricity used in California. However, the competitiveness of power generation using lower quality hydrothermal fluids, geopressured brines, hot dry rock, and magma still depends on the technology improvements sought by the DOE Geothermal Energy R and D Program. The successful outcome of the R and D initiatives will serve to benefit the US public in a number of ways. First, if a substantial portion of our geothermal resources can be used economically, they will add a very large source of secure, indigenous energy to the nation's energy supply. In addition, geothermal plants can be brought on line quickly in case of a national energy emergency. Geothermal energy is also a highly reliable resource, with very high plant availability. For example, new dry steam plants at The Geysers are operable over 99% of the time, and the small flash plant in Hawaii, only the second in the United States, has an availability factor of 98%. Geothermal plants also offer a viable baseload alternative to fossil and nuclear plants -- they are on line 24 hours a day, unaffected by diurnal or seasonal variations. The hydrothermal power plants with modern emission control technology have proved to have minimal environmental impact. The results to date with geopressured and hot dry rock resources suggest that they, too, can be operated so as to reduce environmental effects to well within the limits of acceptability. Preliminary studies on magma are also encouraging. In summary, the character and potential of geothermal energy, together with the accomplishments of DOE's Geothermal R and D Program, ensure that this huge energy resource will play a major role in future US energy markets. 7 figs.

1502 Geology And Hydrology Of Geothermal Systems

19524 **(NP—9770277) Studies on the selection of a site for a hot-dry rock project in the Federal Republic of Germany. Final report.** Rummel, F. (Bochum Univ. (Germany, F.R.). Inst. fuer Geophysik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 30 Aug 1987. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770277/JAW.

The aim of the project was to investigate known or assumed areas in the Federal Republic with increased terrestrial heat flux, to what extent they can be considered as locations for a German Hot-Dry-Rock demonstration project for utilization of earth heat. The investigation was made on the basis of geological, geophysical and logistic data. Investigation regions were: the volcanic areas of the Eifel mountains, 2. the Upper Rhine Rift Valley, 3. Urach and 4. Upper Suabia. The suitability of the individual locations investigated is described. At the same time, the minimum system parameters relevant for an economically operating HDR-demonstration project are defined.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 20510

1509 Geothermal Engineering

19525 **(LBL—26468) Models for aqueous electrolyte mixtures for systems extending from dilute range to the fused salt: Evaluation of parameters to high temperatures and pressures.** Pabalan, R.T.; Pitzer, K.S. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 39p. (CONF-8809239—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006657/JAW.

From Symposium on chemical modeling in aqueous systems II; Los Angeles, CA, USA (25 Sep 1988).

Models based on general equations for the excess Gibbs energy of the aqueous fluid provide thermodynamically consistent structures for evaluating and predicting aqueous electrolyte properties. These equations yield other quantities upon appropriate differentiation, including osmotic and activity coefficients, excess enthalpies, heat capacities, and volumes. For this reason a wide array of experimental data are available from which model parameters and their temperature or pressure dependence can be evaluated. For systems of moderate concentration, the most commonly used model at present is the ion-interaction approach and coworkers. For more concentrated solutions, including those extending to the fused salt, an alternate model based on a Margules-expansion and commonly used for nonelectrolytes was proposed. We discuss these two models and give examples of parameter evaluations for some geologically relevant systems to high temperatures and pressures; also we show applications of the models to calculations of solubility equilibria.

19526 **Multiple-well interference testing in the Ohaaki geothermal field.** Leaver, J.D.; Grader, A.; Ramey, H.J. Jr. (Ministry of Works and Development (NZ)). *SPE (Society of Petroleum Engineers) Formation Evaluation;* **3**: No. 2, 429-437(Jun 1988).

Multiple interference tests were carried out in the Ohaaki geothermal field between 1979 and 1983. Data were collected for periods of up to 200 days per test with both wellhead-mounted water-level recorders and quartz crystal pressure gauges, each with a resolution of about 0.0145 psi [100 Pa]. Data are analyzed by conventional log-log type-curve matching techniques, followed by application of recently developed semilog type-curve matching techniques that allow linear boundary detection without developing two semilog straight lines. One type curve exists for each of the drawdown and buildup data, which are produced by mathematically collapsing the family of curves produced in the solution for a system containing a line source and linear boundary. The type curve for the buildup data has not been previously published. The method allows the inference ellipse for a linear boundary to be determined without any knowledge of reservoir parameters. The data in some tests show the presence of a no-flow boundary for which inference ellipses have been located. Four interference tests performed on the same doublet show that vastly different reservoir parameters can be found unless careful interpretation is made.

16 TIDAL AND WAVE POWER

19527 **(DOE/CH/10093—43) Ocean energy program summary: Volume 1, Overview: Fiscal year 1988.** (Solar Energy Research Inst., Golden, CO (USA)). Feb 1989. Contract AC02-83CH10093. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000858/JAW.

Past studies conducted by the US Department of Energy (DOE) have identified ocean thermal energy conversion (OTEC) as the largest potential contributor to US energy supplies from the ocean resource. As a result, the OET Program concentrates on research to advance OTEC technology. The program also continues to monitor and study developments in wave energy, ocean current and salinity gradient concepts, but it is not actively developing these technologies at the present time. 8 figs.

19528 **(ETSU-TID—4056) Fish passage through tidal energy barrages.** Solomon, D.J. (UKAEA Harwell Lab. Energy Technology Div.). 1988. 113p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report describes the findings of a desk study to consider the likely problems associated with fish passage through tidal energy barrages. It considers passage through turbines and sluices, possible interference with migration caused by the changed hydrodynamic regime, and the potential for fish screening and by-pass systems. The study is based upon published literature, unpublished reports, visits to hydroelectric schemes including tidal power plants, and discussions with fisheries biologists, engineers and turbine manufacturers. Tidal power schemes are likely to involve the passage of a wide range of fish species through the barrage including migratory species (e.g. salmon, shad and eels), estuarine species (e.g. mullet and bass) and marine species (e.g. conger and cod).

17 WIND ENERGY

19529 **(DOE/CH/10093—41) Wind energy program summary: Volume 1, Overview: Fiscal year 1988.** (Solar Energy Research Inst., Golden, CO (USA)). Feb 1989. Contract AC02-83CH10093. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000856/JAW.

The goal of the Federal Wind Energy Program is to establish, by supporting appropriate research, an advanced technology base that will assist industry in designing and producing wind turbines that can serve as an alternative energy supply. The federal effort complements efforts in the private sector to develop wind systems that are safe, reliable, and cost effective. The wind program undertakes research in two general areas: the basic science of wind turbine dynamics, and research on advanced components and systems. Research on wind turbine dynamics includes atmospheric fluid dynamics, aerodynamics, and structural dynamics. The overall goal of these activities is to improve the understanding of the basic physical processes created by the wind turbine's interaction with the incoming wind, with particular emphasis on processes that affect energy capture and structural loading. Research in the advanced components and system areas includes improvements for rotors, such as advanced airfoils, and for generators, such as variable speed operation. The goal of these activities is to develop the technology base necessary for industry to achieve major improvements in wind turbine performance, lifetime, and capital cost.

19530 **(NP—9770275) Wind energy for the Federal Republic of Germany.** (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 29 Feb 1988. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770275/JAW.

A crucial point of promotion of the Federal Ministry for Research and Technology lies in the exploration and utilization of new energy sources. In this contribution the potential, the EEC programmes, small and medium plants, large plants upwards of 800 kW, cross-section and infrastructural measures as well as Federal Ministry for Research and Technology expenses are described briefly, as research objective of the utilization of wind energy.

1704 Economics

REFER ALSO TO CITATION(S) 19698

19531 **(ESC—47) Economical effectiveness of wind energy systems. Calculation model for the determination of the effectiveness under variable starting points.** Van Wees, F.G.; Bakema, G.F. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 138p. (In Dutch). Energie Studie Centrum ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

A model is described for economic analysis of wind energy systems which calculates the internal rate of return and the costs of the electricity produced for various system configurations and management options. Calculations have been made for the economics of four types of wind turbines (16, 25, 34 and 45 m rotor diameter).

Different types of windfarms (isolated wind turbine and 10 or 40 wind turbines in line or cluster) are distinguished. The electricity production, investments- and exploitation costs are estimated for the years 1990 and 2000. The economic calculations present results for two forms of management: by private enterprise or public utilities. A sensitivity analysis has been carried out with respect to differences in wind regime, electricity prices, investments costs and economic lifetime. A data-base on the parameters used is included. 31 figs., 13 tabs., 5 apps.

1705 Environmental Aspects

19532 (ERC—LTR-LA-171) An estimate of the interation of windmills in widespread arrays. Templin, R.J. (National Research Council of Canada, Ottawa, Ontario). 1974. 25p. (CE—02253). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A theoretical estimate is made of the effect of windmill spacing in a large-area array on the mean wind velocity-height profile within the array, and on the reduction of power available due to mutual interference. The results indicate that if the spacing between individual power units is more than about 30 rotor diameters the power reduction per machine will not exceed 5-10%, but as spacing is further reduced there is a rapidly increasing interference, with a corresponding loss in available energy. At about 30 diameters spacing, a large-area array converts wind energy to shaft power at a rate that is only a few percent of the average rate of conversion from solar to wind energy over the same surface area. Thus the array should not significantly affect the wind environment, or the solar-to-wind energy balance. 4 refs., 5 figs., 1 tab.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 19473, 20457

19533 (NRC—LTR-LA-166) An experimental investigation of a 12 ft diameter high speed vertical axis wind turbine. (National Research Council of Canada, Ottawa, Ontario). 1975. 14p. (CE—02254). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

An experimental investigation of a 12 ft diameter high speed vertical axis wind turbine in a wind tunnel is described. The rotor was made to loose tolerances using six straight segments to approximate the ideal blade shape. The experimental program consisted of measurements of: power output; aerodynamic drag at the rotor and the frame structure under operating conditions; and the power output with speed limiting flaps in the operating position. The turbine characteristics were measured in both a three blade and a single blade configuration at rotational speeds of 50-250 rpm and 80-160 rpm respectively. Most of the data was collected at wind speeds of 10-20 ft/s. Measured power output vs tip speed ratio reached ca 0.4 for the single-blade roter and ca 0.6 for the three-blade roter. 2 refs., 6 figs.

19534 (PNL-SA—16406) Estimation of turbulence variance and scale, simplified for wind turbine applications. Powell, D.C. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 8p. (CONF-890175—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006936/JAW.

From 8. American Society of Mechanical Engineers wind energy symposium; Houston, TX, USA (22 Jan 1989).

A simplified method is presented for estimating onsite turbulence variance within the wind turbine layer for horizontal wind speed. The method is based principally on estimating the probability distribution of wind speed and assigning a variance to each mean wind speed based on surface roughness estimates. The model is not proposed as an alternative to onsite measurement and analysis, but rather as an adjunct to such a program. A revision of the Kaimal neutral u-component spectrum is suggested to apply to the mix of the stabilities occurring during operational winds. Values of integral length scale calculated from data analysis are shown to contradict the length scale model implicit in turbulence power spectra. Also, these calculated values are shown to be extremely sensitive to the length of the time series and the detrending method used. 11 refs., 5 figs., 1 tab.

19535 (RISO-M—2603) Wind turbine test. Vestas V25 200 kW. Markkilde Petersen, S.; Schmidt Paulsen, U.; Voelund, P.; Friis Pedersen, T. (Risoe National Lab., Roskilde (Denmark)). Oct 1988. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757059/JAW.

The report describes standard measurements performed on a Vestas V25 200 kW pitch regulated wind turbine. The measurements carried out and reported here comprises the power output, system efficiency, energy production, transmission efficiency, rotor power, rotor efficiency, air-brakes efficiency, structural dynamics, loads at cut-in and braking, rotor torque at stopped condition and yaw errors statistics. (author) 11 tabs., 30 ills., 6 refs.

19536 (RISO-M—2760) Simple wake calculation procedure. Larsen, G.C. (Risoe National Lab., Roskilde (Denmark)). Dec 1988. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757062/JAW.

This report deals with a first and a second order model for the description of the wake behind a wind turbine. The models are based on the turbulent boundary equations, and closed form solutions are obtained for the width of the wake as well as for the mean wind profile in the wake, by adopting a similarity assumption and by utilizing the mixing length theory in the description of the turbulent stresses. The models have been made accessible by being implemented into an interactive program package designed for use on a personal computer. The use of the package is described.

19537 (STU—76-6978) Some innovative concepts in wind turbines of axial-, cross- and combined flow types. Ljungstroem, O. (OLETI-HB, Lidingoe (SE)). (Swedish National Board for Technical Development, Stockholm). 30 Jun 1985. 39p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88757079/JAW.

The concepts reported here are all in the category rotating (turbine) wind energy converter and can be subdivided in three main functional categories namely: Axial-Flow Turbine (AFT), Cross-Flow Turbine (CFT) and Dual (combined)-Flow Turbine (DFT) the latter a combination of system elements applying AFT and CFT. Within the AFT category, two concepts are described: the Swept-Blade Turbine (SWBT) and the Catenary-Ribbon Blade Turbine (CRBT). Augmentation of turbine mass flow and power output by increasing the effective sweep area of AFT can be achieved by moving the rotor hub. Concepts described within the CFT category are LDB (L-blade and Double Blade) to straight bladed CFT-VAWFS, inclined shaft CFT with single and multiple shafts, Spiral Blade Concept, Fluid Ring Bearing VAWT. Further some Dual-Flow Turbine concepts (DFT) are discussed. These consist of a large primary turbine (AFT or CFT) catching wind energy and transferring it directly to a much smaller secondary turbine (or Brade-Turbine, BT) with high rpm, mounted on the primary turbine. Among alternatives discussed are primary AFT and CFT in combination with secondary AFT and CFT. Finally, the potential for future application of the most promising concepts are commented upon.

19538 (STU—78-6740) Vertical axis wind turbine system. Ljungstroem, O. (OLETI-HB, Lidingoe (SE)). (Swedish National Board for Technical Development, Stockholm). 30 Jun 1985. 57p. (In English, Swedish). NTIS (US Sales Only), PC A04. Order Number DE88757080/JAW.

This report covers a continued systems analysis of a selected baseline project LDB125 with 9.5MW rated power and with some design parameter variations for the size range 125-70 m diameter. The VAT1-program has assisted in finding the optimum blade curvature for minimum cyclic blade stresses under the combined action of gravitational rotational and aerodynamic loads. For the largest turbine size LDB125, the blade structure becomes critical. Increase solidity/chord and lowered blade tip speed alleviates these problems. Energy output/turbine cost are nearly equal for LSB125 and LDB125-Ls. The LDB-concept features very high rotor inertia

which simplifies the task of smoothening the output power. A series of models for the power transmission has been analyzed applying various electrical conversion schemes to the VAT1/DYN program. These studies have shown that it is possible to reduce the rotor torque amplitude of magnitude 2xmean torque at extreme V/sub 0/ =30m/s to an output power amplitude of a few percent of the mean power. The turbine mast or tower is the guyed steel mast, the rotor base ring support bearing system and gearing-transmission are the same as presented in the phase 2 study. Comparison between Single Blade (SB) and Double Blade (LDB-LS, Low Speed) configurations with application of 1983 cost levels for investment and cost of energy has been carried out. (L.F.).

20 ELECTRIC POWER ENGINEERING

19539 **(EFI-TR—3421) Information model for electric power and control systems. Model description.** Selvik, E.; Ekrem, D.I. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Jul 1987. 51p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757034/JAW.

Efficient information processing by the use of data handling equipment can improve the electric power plants and installations. A model is proposed for transmission and storing of information about electric energy and control systems. The model is based on preliminary proposals for an International Electrotechnical Commission (IEC) standard for transmission of information about constructions. The model provides entities and relations of the functions, components, and software of the plants and installations. 4 refs., 11 figs.

19540 **(IVO-A—11/87) Development of signal-analysis based expert system for power plant diagnostics.** Markkanen, H. (Imatran Voima Oy, Helsinki (Finland)). Apr 1988. 76p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757046/JAW.

In this report the general requirements for a power plant expert system based on signal analysis methods are studied. A proposal for the functions of such a system is made. An application based on multivariate signal analysis methods was constructed for diagnosing priodical distrubances in a coal-fired power plant. In the theoretical part of this work basic concepts of knowledge engineering and the analysis method used in the prototype are introduced. The power plant process is also described in the extent required for understanding the process models used in the prototype system. In the experimental part the functions of a diagnosis system based on signal analysis methods are discussed in general, and a more thorough description of the prototype system is given. The models of the process and the control of the diagnosis in particular are discussed in detail. The operation of the diagnosis system is described as a modular structure with a fairly general description of the functions and knowledge in each of the modules. Functions implemented in the prototype system are discussed in more detail. The major modules of the prototype system are the models for the structure and function of the process and the model for controlling the diagnosis. This is because it was found that they describe the most important part of the knowledge needed in problem solving. The operation of the prototype is based on the hierarchical functional model of the process.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 19179, 19189, 19213, 19213, 19213, 19565, 19919

19541 **(ANL/PPRNT—89-168) Flyash adhesion in simulated coal-fired gas turbine environment.** Ahluwalia, R.K.; Im, K.H.; Wenglarz, R.A. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008355/JAW.

A rich-quench-lean subscale turbine combustor has been used to expose specimens to the products of combustion from several beneficiated coal-water fuels. An analytical scheme is formulated to extract sticking coefficients from the measured weight gain data, particle size spectrum, and particle density and composition. The inferred sticking coefficients, appropriate for impaction on the pressure surface, range between 0.0003 and 0.11 and are strong functions of the gas and surface temperatures but rather insensitive to the impact angle. The implications of these results to coal-fired gas turbine operation are discussed. 11 refs., 8 figs., 3 tabs.

19542 **(CONF-880925—3) Demonstration plant for the hydrogen/oxygen spinning reserve.** Sternfeld, H.J.; Heinrich, P. (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Lampoldshausen (Germany, F.R.); Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)). 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770273/JAW.

From 7. world hydrogen energy conference (WHEC-7); Moscow, USSR (25 Sep 1988).

In a joint project, the organizations ABB, Balcke-Duerr, DFVLR, EVS, Fichtner, HUels und RWE investigated the technical and economic feasibility of a hydrogen/oxygen spinning reserve (HOS) unit for an industrial steam network and a steam turbine power plant. The results of this investigation indicate that the direct steam generator can be integrated into steam networks and power plants, that the dynamic characteristics of the system as a whole fulfil the requirements of the DVG (West German Association of Grid-Connected Utilities) for providing a rapid rise of power output from power stations, and that the lifetime of the power plant components thus loaded is not shortened. Market potential for such installations and economic aspects of its operation are described.

19543 **(CRIE-U—87045) State-of-the-art of the utilization of thermal effluents and its future R and D plannings.** Iitsuka, Teiji; Okano, Toshiaki; Wasa, Akira. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756462/JAW.

The object of this report is to study the system increasing the use of the thermal effluents from thermal power plants and nuclear power plants by collecting and classifying 153 reports on the utilization of thermal effluents. The principal applications of the thermal effluents are now for marine nursery and culture in direct use and for greenhouse heating; these are the same situations in Japan and foreign countries. The amount of the thermal effluents use is only 0.667 m^3/s (0.05% of the total from nuclear power plants) and 1.182 m^3/s (from thermal power plants). It is mostly used in researchs. To increase the use of the thermal effluents, the concept of the application systems were considered for the ground and sea, respectively. The thermal effluents from thermal power plants, usually constructed near cities, is considered to be useful compared with that from nuclear power plants, constructed near sea coasts. The development and improvement of fishing grounds is one of the uses of the large flow of thermal effluents. (8 figs, 3 tabs, 43 refs)

19544 **(CRIE-U—87069) Development of techniques for marine macrophyte bed creation in the coastal zone near a power plant(8) Estimation method of stability of sand bed.** Maruyama, Koki; Igarashi, Yoshio; Ishikawa, Yusuke; Kawasaki, Yasuo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jul 1988. 29p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756463/JAW.

Eelgrass beds distributed over quiet zone such as an interior bay are important from the view point of both fisheries and environmental resources. Since 1982, Central Research Institute of Electric Power Industry has studied the techniques for creation of eelgrass beds, and in the study process, the loss of eelgrass shoots induced by sand movement became one of the problems to be investigated. In order to know the suitable environment for creation of eelgrass, the judging method for the suitable environment was investigated from the view point of the stability of sand bed. The field observations were carried out in the Odawa Bay, the Miura Peninsula, Kanagawa Prefecture; and the distribution of eelgrass, relationship between sand bottom changes and wave heights were measured. Sand transport rate were measured in hydraulic experi-

ments using glass sand under the conditions of coexistence of wave and current, and an unified empirical formula was proposed. Lastly, figures of critical values of wave and current are proposed which can be used for estimation of stability of sand bed where transplanting of eelgrass could be achieved. (14 figs, 4 tabs, 1 photo, 21 refs)

19545 **(CRIE-U—87094) Feasibility of underground compressed air energy storage for gas turbine plant.** Ogata, Seiken; Komada, Hiroya; Honsho, Shizumitsu; Fujiwara, Yoshikazu; Motojima, Mutsumi; nishi, Koichi; Hayashi, Masao. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jul 1988. 62p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756466/JAW.

Underground compressed air energy storage application for gasturbine power plant is expected as new power generation system to cope with load fluctuation. Following the system of 240 MW out put, if underground storage can be constructed at around 13 billion yen (fiscal 1987), the system concept would benefit. Feasibility assessment has been performed on the construction of new plant with output of 240 MW, peak operation of 8 h at the vicinity of the metropolitan area. The conditions of the study are as follows: Three types of foundations such as hard rocks, volcanic rocks and semi-hard tertiary rocks are selected; configuration depends on site requirement; and as for the properties of each rocks, the strength, permeability and ground-water distribution are considered. This investigation indicates that optimum siting design concept is a storage at 40-60 kgf/cm^2 in hard rocks and the best economy is in the site of 400m topographic relief at 40 kgf/cm^2. (26 figs, 23 tabs, 16 refs)

19546 **(CRIE-W—86031) Development of the performance analysis program for IGCC heat recovery system.** Mimaki, Toshio; Moritsuka, Hideto; Hamamatsu, Teruhide; Ishikawa, Hiroshi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 73p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756467/JAW.

In order to improve the thermal efficiency of IGCC plants, the softwear capable of analyzing the heat balance and thermal efficiency of four different types of heat recovery systems with various heating surface arrangements was developed, and the most efficient heat recovery system was investigated basically. The four types of systems were assumed as follows: the mixed pressure-reheat type system that a secondary superheater and reheater were arranged ahead of a gas cooler to improve the heat recovery on the low temperature side, the same type system that a high pressure evaporator was arranged ahead of a gas cooler to lower the temperature of piping materials under high temperature condition, the same type system that used medium mixed pressure and had most excellent overall efficiency, and the non mixed pressure-reheat type compact system although most inferior in thermal efficiency. As a result, from the viewpoint of a thermal efficiency, the medium mixed pressure type system that a superheater and reheater were arranged ahead of a gas cooler was considered to be most promising. (33 figs, 15 tabs, 4 refs)

19547 **(DOE/CE/40716—3) Assessment of heat transfer enhancement and fouling in industrial heat exchangers: Final report.** Rebello, W.J. (PAR Enterprises, Inc., Fairfax, VA (USA)). Nov 1987. Contract AC01-84CE40716. 149p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005620/JAW.

Since the oil embargo of 1983--1984, energy costs have motivated industry to improve the performance and reliability of heat exchangers by using enhanced heat transfer surfaces. In addition, because of the high economic penalty caused by fouling, research in the area of fouling has increased. In recent years, several international conferences have been held by academia and industry to report on and discuss research opportunities in the area of heat transfer enhancement and fouling. These research opportunities have been prioritized based on the assessment and judgment of the experts in the field. This report, representing a four man-month effort, is an attempt to determine the impacts of heat exchanger enhancement and fouling on energy and capital costs so as to set some priorities for the various research opportunities. As a result of the literature review, a brief overview of enhancement and fouling has been provided and serves as a ready reference. 54 refs., 4 figs., 31 tabs.

19548 **(EPRI-EL—6183) Bulk power system voltage phenomena: Voltage stability and security: Proceedings.** Fink, L.H. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA); Carlsen and Fink Associates, Inc., Fairfax, VA (USA)). Jan 1989. 601p. (CONF-880981—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89007809/JAW.

From Bulk power system voltage phenomena: voltage stability and security; Potosi, MO, USA (19 Sep 1988).

This volume contains the proceedings, papers and discussions, of an international workshop on "Bulk Power System Voltage Phenomena: Voltage Stability and Security." The workshop was sponsored by the National Science Foundation and the Electric Power Research Institute, in cooperation with the Engineering Foundation, and was held at Trout Lodge, Potosi, Missouri. The objective of the workshop was to bring together experienced operators, planners, consultants, and academics for the purposes of enhancing their mutual understanding of the phenomena involved, and of stimulating research and development on algorithmic tools adequate to the needs of the industry. Following a keynote session, the next three sessions were intended to delineate current perceptions of voltage related problems by experienced power system engineers. The following two sessions explored current analytic understanding of those problems by academic investigators. The final three sessions were intended to stimulate thinking about potential advances in voltage security analysis and control. Each section of these Proceedings opens with the invited survey paper(s) on the session topic, followed by any contributed papers, and then by a summary of the ensuing discussion.

19549 **(KFK—4463) Combined-cycle power plants with integrated gasification of hard coal. State of development, efficiency, cost effectiveness, environmental implications.** Schulz, V.; Findling, B.; Nieke, E.; Tangen, H.; Wintzer, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). Nov 1988. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757162/JAW.

This report deals with the technical and economic parameters and the environmental aspects of coal-fired (hard coal) power plants with integrated gasification and combined-cycle process (IGCC). First, the current state of development is presented, with special regard to the different coal gasification technologies. Next, the efficiency potentials for electricity generation are discussed with special emphasis on identifying the main influencing factors. This is followed by a cost comparison with conventional coal-fired power plants and electricity generation from natural gas. A comparative analysis of the environmental aspects of IGCC power plants and conventional coal-fired power plants is given at the end of the report.

19550 **(STEV-VK—88-8) Diesel engine combined with a fluidized bed for the production of heat and power.** Wingaard, S.; Aamand, L.E.; Leckner, B. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Energy Conversion). (Statens Energiverk, Stockholm (Sweden); Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Energy Conversion). Oct 1988. 27p. (In Swedish). (CTH-IE-A—88-175). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757077/JAW.

From a thermodynamic point of view a diesel engine with heat recovery is one of the best prime movers for liquid and gaseous fuels of high heat value. The high emissions of nitric oxide require some kind of exhaust cleaning if the engine is to be used for continuous production of heat and power. One possible way of cleaning the exhaust gases is to connect the engine with a fired boiler of circulating fluidized bed (CFB) type. The oxygen-containing gas from the diesel engine replaces the air to the boiler. This concept has been tested by injecting nitric oxide in the air channel of an 8-megawatt CFB boiler. When injecting 1200 to 2200 ppm of nitric oxide, based on total air flow, the conversion of nitric oxide was 75-90%. Three fuels were used: petroleum coke, coal and a mix of coal and wood chips. The mix of coal and wood chips

showed the highest conversion, and petroleum coke the lowest. A part of the nitric oxide, about 5%, was converted to nitrous oxide (N/sub 2/O). When firing supplementary in the exhaust gases the electric efficiency, based on total supply of fuel, is reduced. Total efficiency (electricity plus heat) increases, except in configurations when the boiler produces steam for a condensing steam cycle. Compared with gas turbines, the diesel engine has both higher electric efficiency and higher total efficiency. When the respective machines are combined with a steam cycle, the difference is reduced but the diesel engine is still better. This is especially true when comparing small engines. (authors).

19551 **(SV-UE—1988-20) Reliability modelling of composite power systems.** Dillon, T.S.; Backlund, Y. (Swedish State Power Board, Vaellingby). 28 Apr 1988. 119p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757093/JAW.

In this report we examine the problems associated with development of models for security and reliability analyses of composite power systems, particularly the Swedish and Nordel systems. The report addresses conceptual questions, definition problems, modelling issues, mathematical and computational approaches, problems of acquiring required data and the uses of the reliability indices computed. (With 30 refs.) (authors).

19552 **(SV-UV—1987-47) Evaluation of the Power Board's efforts to date in connection with the combustion of solid fuels.** Hunyadi, L.; Granberg, G.; Gruvman, G.; Rehn, Aa.; Johansson, R. (Swedish State Power Board, Vaellingby). 13 Nov 1987. 106p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757102/JAW.

This report presents the experience gained from 18 solid fuel-fired plants in which Vattenfall, the Swedish State Power Board, has in some way participated, either in their establishment or in their establishment, operation and ownership. The evaluation of the Power Board's efforts to date in connection with the combustion of domestic fuels is intended, among other things, to provide a foundation on which to base decisions on future efforts and the direction they should take. For follow-up purposes, attention has in the first instance been concentrated on the period of firing between December 1986 and April 1987. However, the experience gained during this time has had to be supplemented by information from the period prior to December 1986. The report describes the design of the plants and specifies basic data. One of the chapters is devoted to the experience gained in connection with planning, design, procurement and construction, and another chapter to the fuels used and the way they were obtained. Operational experience, environmental surveys and economy are each described in separate chapters. Brief presentations are given of other investigations on the subject of solid fuel firing conducted outside the Swedish State Power Board. Finally, a forecast is made of the technical methods that are expected to be adopted in future solid fuel-fired plants. (authors).

19553 **Turbomachinery debris remover.** Krawiec, D.F.; Kraf, R.J.; Houser, R.J. (to Dept. of Energy, Washington, DC). US Patent 4,792,276. 20 Dec 1988. Filed date 22 Sep 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a debris remover apparatus comprising: a housing means including a flexible hollow hose, the housing means defining an opening; first mounting means attached inside of the housing means adjacent to the opening, the first mounting means having an elongated first shaft disposed adjacent to the opening; grappling finger means attached to the first mounting means, the finger means being mounted on the first shaft for controlled pivotal movement on the first shaft whereby a portion of the grappling finger means is rotatable between a position inside of the housing means to a position outside of the housing means, the grappling finger means also being mounted on the first shaft for controlled translational movement along the axis of the first shaft; second mounting means attached inside of the housing means adjacent to the opening, the second mounting means having an elongated second shaft disposed adjacent to the opening; fiberoptic viewing means in the housing means and having one end mounted on the second mounting means, the one end being mounted for controlled translational movement along the axis of the second shaft.

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REFER ALSO TO CITATION(S) 19199, 19200, 19213, 19216, 20147

19554 **(EPRI-EA—6095-Vol.5) A hierarchy of dynamic plume models incorporating uncertainty: Volume 5, Pennsylvania State University mesoscale model (PSU-MM): Final report.** Lewellen, W.S.; Sykes, R.I.; Parker, S.F.; Henn, D.S.; Seaman, N.L.; Stauffer, D.R.; Warner, T.T. (Electric Power Research Inst., Palo Alto, CA (USA); California Research Technology, Princeton, NJ (USA). ARAP Div.). Feb 1989. 135p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89007811/JAW.

An existing mesoscale model (the Penn State University/National Center for Atmospheric Research mesoscale model) was extended for use with a PUFF-type plume model. By including a fine-mesh 2 km nested-grid and the assimilation of 4-dimensional data, horizontally variable hourly-average meteorological conditions can be simulated up to 300 km downwind of stack emissions in complex terrain. In 4 days of tests (32 90-minute periods) against meteorological observations obtained in moderately complex terrain, wind-speed uncertainties are usually less than 3.3 m/s, and direction errors are less than 40{degree} for winds less than 1 m/s. The performance of this model was also compared on 3 days (20 hours) with a locally homogeneous meteorological data assimilation model when both were coupled to a new second order closure integrated puff model (SCIPUFF). Use of the new mesoscale model slightly reduced the deviations between simulated and observed concentrations of SF_6 tracer, even within 50 km. At distances longer than 50 km (not tested) it is expected that use of the mesoscale model would further improve dispersion simulations. 8 refs., 26 figs., 6 tabs.

19555 **(EPRI-GS—6208-Vol.1) Proceedings: Seventh particulate control symposium: Volume 1, Particulate/SO_2 control with electrostatic precipitators.** (Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Research Triangle Park, NC (USA)). Feb 1989. 598p. (CONF-880305—Vol.1). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008056/JAW.

From 7. symposium on the transfer and utilization of particulate control technology; Nashville, TN, USA (22 Mar 1988).

The objectives of the Symposium were to encourage the exchange of new knowledge in the particulate control field among designers, users, and researchers, and to stimulate new ideas that will lead to further technological improvements in the future. Fabric filters and electrostatic precipitators were the major topics, but novel concepts and advanced technologies were also explored. Topics discussed include: particulate control for incinerators; dust properties; full-scale fabric filter studies; power supplies and controls for precipitators; full-scale fabric filter studies II; advanced SO_2/particulate control studies; precipitator performance evaluation and upgrading; fabric filter pilot-scale studies; and precipitator modelling. Individual projects are processed separately for the data bases.

19556 **(SVF—311) Thermal NO/sub x/ reduction by means of additives.** Persson, K. (ABB Carbon, Finspaang (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Aug 1988. 173p. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757105/JAW.

Ammonia and urea are effective NO/sub x/ reducers in a narrow temperature range between 870 and 1100 deg C. Other nitrogen containing organic compounds, for example amines and amine salts, give high NO/sub x/ reduction at temperatures down to about 500 deg C. In order to improve the NO/sub x/-reducing effect at lower temperatures when ammonia and urea are used. the additives can be combined with other reducing agents or with a radical initiator as amino radicals are involved in the NO-reduction reactions. The possible degree of NO/sub x/-reduction is limited by the fact that the stochiometric ratio between the additive and NO/

sub x/ must be maintained at a level which will prevent excessive penetration of ammonia. Between 40 and 70% NO/sub x/-reduction is realistic. Other important factors for thermal NO/sub x/-reduction are basic NO/sub x/ emission level, O/sub 2/ content, residence time, mixing and design of the boiler. The costs for thermal deNO/sub x/ varies between 7000 and 12500 SEK/ton NO/sub x/ depending on degree of NO/sub x/-removal, operation time and boiler.

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REFER ALSO TO CITATION(S) 19542, 19548, 19942

19557 **(CRIE-T—04) Corona effects of UHV AC overhead transmission lines.** Sasano, Takao; Tomita, Seietsu; Tanabe, Kazuo; Deguchi, Yoshihiro; Harada, Hiroshi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1988. 139p. (In Japanese). NTIS (US Sales Only), PC A07. Order Number DE88756453/JAW.

Corona effecrts of UHV class conductor systems have been studied using the Akagi test line and UHV corona cage testing facilities. Main results by the tests are as follows, (1) It was confirmed by the demonstration test using the Akagi test line that the predicted methods of audible noise and radio interference, which had been already proposed, were extremely precise. (2) In order to predict the hum noise and corona loss of UHV class conductor systems, experimental formulae were developed. (3) The correct factors were obtained for the conductor system wound with spiral wires to reduce the aeolian noise. (4) It was confirmed that the corona loss, television interference and ozone due to conductor corona, are not important factors when UHV class conductor systems are designed. (5) It was found that UHV class conductor systems from the viewpoint of corona effects is determined by audible noise in almost all cases. (93 figs, 33 tabs, 5 refs)

19558 **(CRIE-T—37040) Characteristics of winter lightning to high structures. Observation from December 1978 to March 1987.** Miyake, Kunihiko; Mitani, Hiroshi; Inoue Atsuyuki; Yokoyama, Shigeru. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). May 1988. 38p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756454/JAW.

From the observation results of winter lightning to independent high structures during nine years from the year 1978, a data base was structured and statistically analyzed. Totally 416 times of observation were made at the three points, ie, Kashiwazaki, Fukui and Nakanoto. Lightning stroke was recorded 181 times/8 years at Kashiwazaki, 184 times/7 years at Fukui and 51 times/6 years at Nakanoto. The number of annual winter lightning strokes to the structure, to which the number of lightning strokes is the largest at each point, was larger than that of summer's and propotional to the height above ground of structure. Their cumulative frequency distribution of lightning stroke current peaks does not largely differ from that of summer's. The ratio of positive polarity to negative polarity for the number of lightning strokes is 1 to 2, which indicates a larger number of positive polarity's than 1 to 19 being that of summer's. The wave front time of lightning stroke of positive polarity current is wide in distribution, while 90% of the negative polarity's is within 50 microseconds. The electric charge quantity of winter lightning extends in a range from less than 1 Coulomb to more than thousands of coulomb which is much larger than the summer's being tens of coulomb. The vertical lightning stroke angle is mostly approx. 35 degrees and may to reach 85 degrees. (28 figs, 5 tabs, 13 refs)

19559 **(CRIE-T—87036) Studies on corona and field effects of Shiobara HVDC test line (Part 8). Characteristics of small ion mobilities.** Suda, Tomotaka; Sunaga, Yoshitaka. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1988. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756455/JAW.

Fabricating a cocylindrical ion counter which is able to measure directly the ion mobility and density, small ion mobility spectra were measured under the Shiobara UHVDC test line throughout all seasons in the year and those characteristics were clarified. Small ion mobility spectra under the test line were different from the relatively flat spectrum in natural air, and both positive and negative small ion mobility were distributed around the area of 1.2-2.1 $cm^2/V*s$ collectively. The avarage positive and negative small ion mobilities under the test line were 1.34 +-0.31, 1.56 +-0.21 $cm^2/V*s$ respectively, and test results with higher reliability were obtained statistically under the line for practical applications. Indirect measured data coincided with direct measured ones with the ion counter with the accuracy of +-30%. In consequence of the test results, it was clarified that statistical evaluation and estimation of the ion density under the line were able using the average ion mobility and indirect measured data. (12 figs, 12 tabs, 22 refs)

19560 **(CRIE-T—87037) Effect of surge wave from on evaluation of lightning impulse test voltage for GIS.** Fujinami, Hideo; Takuma, Kaoru; Kawamoto, Tadashi. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). May 1988. 30p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88756456/JAW.

Because the wave form of lightning overvoltages entered to a gas insulated substation (GIS) is formed with steep-fronted and gently slope-tailed impulse superposing on high frequency oscillation component, there are many differences of wave form between the standard test impulses and the lightning surges. In order to clarify the influence of voltage wave form upon the insulating performance of the gas insulated equipment subjected to lightning overvoltages, the lightning impulse test voltage equivalent to the lightning surges was appraised by applying the equal voltage-time area criterion to V-t characteristics in GIS for those wave forms. In the case of same wave amplitude, the wave form of standard test condition was more severe for insulation than one of lightning overvoltages with high frequency oscillation. However, special attention was given to the tolerance of coordinated condition with a lightning arrester in the short transition time. The standard lightning impulse test voltage equivalent to the maximum lightning surge voltage was studied for 500kV and 275 kV GIS, and the tolerance of lightning impulse test voltage was conducted. (21 figs, 4 tabs, 12 refs)

19561 **(CRIE-T—87075) Transient stability study for various kind of unbalanced-fault in electric power system.** Asada, Minoru; Tanaka, Kazuyuki; Ishihara, Takumi; Kawamoto, Seiji; Sugihara, Hiroaki. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jul 1988. 50p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756459/JAW.

As the stability and system coordination must be maintained when a fault occurs due to lightning or other causes in the power transmission line, limits of transient stable transmission under unbalanced fault were investigated. Faults over two circuits and the transient stability in the transmission line were simulated. The stability requirements for the fault of one phase, two conductor grounding or two phase, three conductor grounding over two circuits are stricter than those for three phase, three conductor on one circuit. Transient stability in a model system of 500 kV power transmission from a large capacity power source was simulated with the fault mode (number of phases in fault and combination of open phase of line) and distance of transmission (100 - 300 km) as parameters. The order of power limit levels for transient stability in each fault mode did not vary with transmission distance. The order of power limit levels in a ultra-high voltage system is determined by the combination of open phases rather than the number of fault phases. The order can be estimated by theoretical values in the equivalent synthetic impedance method. (43 figs, 12 tabs, 5 refs)

19562 **(CRIE-W—86040) Study on size reduction of underground transformer by heat pipe cooling.** Imajo, Tadahisa; Kawahara, Kiyofumi; Sato, Masahiko. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 35p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756468/JAW.

For the purpose to reduce the construction cost of underground distribution, an experiment was carried out for the size reduction of underground transformers with heat dissipation by a heatpipe. and its cost reduction was estimated. A new useful heat-

pipe connector was developed to connect a heat absorption part of a heatpipe immersed in transformer oil and a buried radiation part. The effect of heat dissipation was studied using a full size underground transformer(30+70kVA), a heatpipe and above connector, and an equation to calculate temperature rise of the transformer and heatpipe was also derived. As a result, it was revealed by use of the heatpipe that the sizes of the transformer and handhole for transformer were possible to be reduced to as half and one eighth as that of conventional ones, respectively. In the case of combination of the closed handhole and heatpipe radiation pipe, the cost was estimated to be reduced to about 70% of that of conventional one, furthermore, in cases where the handhole had a ventilation grating and screen, it was only about 40%. (15 figs, 5 tabs, 8 refs)

19563 **(CRIE-W—87003) Development of new insulators for 20kV class distribution lines.** Kazuma, Yasukuni; Fukazawa, Mamoru. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 30p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756470/JAW.

As a part of the cost reduction of distribution materials, two types of new anti-pollution type insulators (type I: compact type and type II: heavy duty anti-pollution type) for 33kV distribution lines were developed. The insulators contained no alumina and were shaped like a elliptical sphere on the both sides of a conductor and base fitting. By the withstand voltage test of unit insulators for arc-jet, the fine arc-proof capabilities were confirmed over the arc current range of 1-12kA in comparison with existing non-alumina insulators. By the arc-proof test using arc-horns over the arc current range of 1-4kA, the remarkably improved arc-proof capabilities of the insulators fitted with arc-horns were confirmed in comparison with that of the unit insulators. By the anti-pollution capability test in a fog chamber, only type II insulator filled the required capability in heavy polluted area, however, the capability was slightly inferior to existing insulators. (23 figs, 2 refs)

19564 **(CRIE-W—87012) Short-circuit fault characteristics of 400V class distribution lines (Part 2). Influence of Areson limiting of fault current.** Sekiguchi, Terukazu; Okazaki, Masayuki; Inaba, Tsuginori. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Dec 1987. 29p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756471/JAW.

To meet the increase in electric power consumption by the demanders, the 200 V distribution by a single phase three-wire method and 400 V class power distribution are being introduced for low voltage power distribution. The increase in that voltage resulted in this report research, as a countermeasure against the short circuit fault, the restraint on short circuit current caused by arcs. Because the arc electric field becomes almost constant in intensity with both the electrodes becoming distant, the arc voltage increased almost proportionally to the gap between electrodes and exhibited the tendency to become high with the electric current becoming weak. Then experimental formulas were introduced to establish the average voltage during the arcing. Both the arc voltage and electric field intensity in case of the aluminium electrodes are approx. 20% lower than those of copper's. The gap between electrodes required for the self arc extinction is 1 cm at 210 V and more than 16 cm at 420 V at the electric source. The arc short circuit is current limited from 90 to 50 % of that of metal's. The current limitation by arc having been calculated, that calculated value very much coincided with the actually measured value of same. (16 figs, 5 tabs, 2 refs)

19565 **(EPRI-EL—6207) Evaluation of diagnostic techniques for cable characterization: Final report.** Crine, J.P.; McNicoll, Y.; Pelissou, S.; St-Onge, H. (Electric Power Research Inst., Palo Alto, CA (USA); Institut de Recherche d'Hydro-Quebec, Varennes (Canada)). Feb 1989. 323p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89007735/JAW.

The main objective of this project was to seek out and evaluate analytical techniques for characterizing extruded dielectric insulating materials. These techniques were also expected to allow a greater understanding of the phenomena involved in the aging of high voltage cables. The following specific goals were emphasized in this research project: (1) evaluation of bulk and localized cable contamination, (2) determination of the radial distribution of density, (3) detection of insulation's oxidation and curing by-products, (4) localized measurements of surface tension, (5) reliable and accurate measurements of water in cables, (6) determination of the chemical nature of the water-polymer interaction in relation to treeing, and (7) estimation and visualization of the microscopic motion and distortion of polyethylene during tree growth. 39 refs., 153 figs., 24 tabs.

19566 **(IVO-A—04/88) On-line location of partial discharges in power transformer through acoustic emission.** Eronen, H. (Imatran Voima Oy, Helsinki (Finland)). Jun 1988. 31p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757043/JAW.

The detection and location of partial discharge faults in power transformers make it possible to minimize the repairing costs and time out of use. This report deals with a movable equipment, which was designed for on-line locating of partial discharges. A partial discharge generates oscillations at the ultrasonic frequency range, which propogate through the surrounding insulation materials to the walls of a transformer tank. These signals are possible to be indicated by acoustic emission transducers and measuring of differences in propogation times at different points makes it possible to calculate the location of a discharge. The measuring equipment consists of four acoustic emission transducers with their amplifiers, a signal memory recorder and a microcomputer. When the transducers detect a signal, the recorder reads it in its memory, where it can be manipulated and averaged for damping of noise. The microcomputer reads the signals coming from different transducers from the memory of the recorder and calculates the propagation times at different channels by which it locates the discharge. The device was tested in the laboratory at a tank filled with transformer oil and equipped with a discharge source. This was necessary for studying of basic principles of the phenomenon. Later the tests continued at a damping reactor, which nearly corresponds a power transformer. The tests show, that the equipment is capable to reliable location at an accuracy of 50 mm, when the discharge level exeeds 150 pC. In special circumstances at /sup d/ead zones/sup /in transformer constructions the locating may be impossible.

19567 **(KEMA—62299-DPA-87-270) Electric power transport now and in the future. Section study renewable energy.** Adami, H. (Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands)). May 1987. 61p. (In Dutch). N.V. Tot Keuring van Elektrotechnische Materialen, P.O. Box 9035, 6800 ET Arnhem, Netherlands.

Within the framework of research on renewable energy supply, with regard to the next 50 years, the transport of electric power is dealt with. Transport by means of electric power distribution and underground, overhead or submarin electric conductors. Also discussed are transport systems, alternate current and direct current, developments in the field of conductors, technologies, losses and economical aspects dependent on high voltages and capacities of 500 MW and higher for distances of about 50 to 2500 kilometers. Finally attention is paid to technological developments and prospects of the extraterrestrial solar energy conversion and transfer to the earth by means of microwave energy (Solar Power Satellite, SPS). 33 figs, 62 refs., 7 tabs.

19568 **(SERI/TR—254-3386) Effects of feedback on residential electricity consumption: A literature review.** Farhar, B.C.; Fitzpatrick, C. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1989. Contract AC02-83CH10093. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000872/JAW.

This report reviews 17 studies assessing the effect of information feedback on residential electricity consumption. Most of the studies were conducted in experimental or quasi-experimental conditions. The studies reviewed used (1) both feedback and incentives, (2) goal setting, (3) cost information feedback, and (4) displays. The study findings, taken together, provide some evidence that feedback is effective in reducing electricity consumption, although questions remain concerning the conditions under which feedback can best be provided. Reductions in consumption found in most of the studies

ranged from 5% to 20%. Utility companies are the most likely source of feedback information for residential customers. Three of the studies investigated utility feedback projects. The report discusses the policy implications of these as well as the other studies. The report also lists questions remaining to be researched. 13 refs., 1 tab.

19569 **ICCS for DC applications.** Marston, P.G.; Hale, J.R. (MIT Plasma Fusion Center, Cambridge, MA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1209-1210(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Superconducting magnet windings in which AC heating is insignificant can benefit from the elimination of transient heat transfer limits on stability and also from the use of high strength, moderate conductivity copper and aluminum alloys for thermal "protection". The way in which these benefits accrue from the use of ICCS for DC devices is described.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 19675, 20297, 20299, 20300, 20314, 21560

19570 **(ENEA-RT-PAS—88-17) SMANT: a complete code to determine the optimal sequence of dismantling of nuclear power plant components in order to reduce occupational doses.** Mincarini, M. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 131p. (In Italian). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705439/JAW.

The computer program SMANT, developed to assess the best disassembly sequence in case of decommissioning of nuclear installations, is presented in the report. The program is mainly related to: (1) amount of working time; (2) adsorbed doses of radiation by operator teams; (3) available segmenting processes for components piping and walls. An example of application to a real nuclear installation is also presented in appendix.

19571 (INIS-mf—11896, pp 12.1-12.20) **German NDE within the PISC II program.** Deuster, G.; Weiss, R.; Schmuelling, W. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Inspections according to KTA 3201.3 which are commonly used on site in the FRG, are fully satisfactory for the detection of defects larger than 3 mm. The analysis methods available for the required reconstruction of real defect geometry, espec. in the assessment of the extension of defect depth, have resulted in under estimations in individual cases; this is explained largely by shadowing effects.

19572 (INIS-mf—11896, pp 18.1-18.27) **Apparative development for in-service inspections of reactor pressure vessels.** Stanger, H.K.; Kappes, W.; Neumann, R.; Barbian, O.A.; Bohn, H.; Ruthrof, K. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.); Salzgitter Industriebau G.m.b.H. (Germany, F.R.); Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

These most recent developments of an improved manipulator and completely automated ultrasound data acquisition, processing and evaluation meets all requirements made on in-service and initial inspections of reactor pressure vessels. The ALOK data acquisition and evaluation system improves the capabilities for defect detection and analysis without extending the times for checking the detection data. The fully programmable manipulatur in combination with phased-array probes and ALOK technique result in a major simplification of test procedures, testing times and radiation exposure of inspecting and operating staff.

19573 **(KFKI—1988-24/G) Experimental study of the field-of-view of neutron detectors towards thermohydraulic perturbances.** Kozma, R.; Hoogenboom, J.E.; Dam, H. van. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Interuniversitair Reactor Inst., Delft (Netherlands)). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). May 1988. 24p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705567/JAW.

The aim of the present study was to identify different stages of boiling during the HOR experiments at the 2 MW reactor of IRI (Interfaculty Reactor Inst.), Delft, Netherlands. The electrical heating power was increased while the flow rate was constant, thus inducing a single-phase flow, and afterwards subcooled boiling and finally developed volume boiling of the coolant in the experimental assembly. Subcooled boiling and the onset of boiling could not be detected using neutron detectors. This behaviour shows that the field of view of the NDs is very limited. The neutron noise signals remained unchanged, though at a distance of 3-10 cm developed volume boiling arose. Only the steam-packets in the slug-type flow during measurement III caused changes in the neutro noise. (author) 12 refs.; 20 figs.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 19315, 19655

19574 **(BNL-NUREG—42156) Using data bases to understand aging.** Subudhi, M.; Lofaro, R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880824—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007043/JAW.

From International nuclear power plant aging symposium; Bethesda, MD, USA (30 Aug 1988).

A great deal of nuclear power plant operating experience has been documented in the form of national data bases. Individual plant maintenance records, design and manufacturing data, equipment qualification documents, and other published reports provide an enormous amount of information that can characterize a component. This can be of great importance in examining and understanding the effects of aging on plant performance and safety. To obtain meaningful results, however, the strengths and weaknesses of these data sources must be recognized and accounted for. This paper discusses the various data bases currently available. The type of information provided in each is explained, as well as the advantages and limitations of each data source. Their application to aging analyses are discussed. The need for a review process of a data source to utilize information for aging analyses is also included. Validation of the data using plant specific data is also discussed. Aging characteristics of components, systems or structures in nuclear power plants are discussed. Examples are presented to demonstrate the feasibility of obtaining this information from the various data sources available. Results from the aging studies performed at Brookhaven National Laboratory under the Nuclear Plant Aging Research (NPAR) are used for illustrations. 8 refs., 7 figs., 1 tab.

19575 (INIS-mf—11896, pp 8.1-8.25) **Experimental study on the application of acoustic emission during the hydraulic pressurization of a RPV.** Gehrhardt, H.J.; Eisenblaetter, J.; Jax, P.; Maier, H.J.; Waschkies, E. (Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.); Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt; Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The study object was a BWR pressure vessel featuring tailored defects in welds and base material. Six pressure measurements up to operating pressure (71 bar) were performed. Global multichannel detection as well as local monitoring were used. Global detection allowed to confirm a number of different signals in parallel; a number of hitherto undetected defects in the welds were also detected and verified by subsequent NDT. Local detection with signal analysis was demonstrated to improve detection accuracy by a factor of 20 to 30 compared with global detection.

19576 (INIS-mf—11896, pp 9.1-9.11) **Analyzing the deformations of the head of a 900 MW reactor pressure vessel with holographic interferometry.** Kussmaul, K.; Ettemeyer, A. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

MPA Stuttgart acquired an advanced high-performance holographic system which allowed to implement deformation analyses on an original 900 MW RPV for the first time. Such large objects require special holographic systems and the introduction of a new evaluation method for holograms. The authors report on the experience gained in the study of the 900 MW RPV head.

19577 (JAERI-M—88-200) **Summary report on the international comparison of NEACRP burnup benchmark calculations for high conversion light water reactor lattices.** Akie, Hiroshi; Ishiguro, Yukio; Takano, Hideki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 288p. (NEACRP-L—309). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88756917/JAW.

The results of the NEACRP HCLWR cell burnup benchmark calculations are summarized in this report. Fifteen organizations from eight countries participated in this benchmark and submitted twenty solutions. Large differences are still observed among the calculated values of void reactivities and conversion ratios. These differences are mainly caused from the discrepancies in the reaction rates of U-238, Pu-239 and fission products. The physics problems related to these results are briefly investigated in the report. In the specialists' meeting on this benchmark calculations held in April 1988, it was recommended to perform continuous energy Monte Carlo calculations in order to obtain reference solutions for design codes. The conclusions resulted from the specialists' meeting are also presented.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 19315, 19574, 19577, 19618, 19639, 19644, 19646, 19647, 19648, 19649, 19653, 19655, 20298

19578 **(EGG-M—88196) TMI-2 core shipping preparations.** Ball, L.J.; Barkanic, R.J.; Conaway, W.T. II; Schmoker, D.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 27p. (CONF-881024—14). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005202/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, USA (30 Oct 1988).

Shipping the damaged core from the Unit 2 reactor of Three Mile Island Nuclear Power Station near Harrisburg, PA, to the Idaho National Engineering Laboratory near Idaho Falls, ID, required development and implementation of a completely new spent fuel transportation system. This paper describes the equipment developed, the planning and activities used to implement the hardware systems into the facilities, and the planning involved in making the rail shipments. It also includes a summary of recommendations resulting from this experience.

19579 **(GKSS—88/E/49) Advanced development and operating experience with a canned motor pump under pressurized water reactor conditions.** Dittmer, H.; Reymann, A.; Seibig, B.; Reinecker, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hermetic-Pumpen G.m.b.H., Gundelfingen im Breisgau (Germany, F.R.)). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 26p. (In German). (CONF-8810324—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757123/JAW.

From 4. pump congress: pumps and their application; Karlsruhe, F.R. Germany (4 Oct 1988).

At the research reactor FRG-2, Geesthacht, an irradiation device is in operation for testing defective light-water-reactor (LWR) test fuel rods under pressurized water reactor conditions (320/sup 0/C, 160 bar). The requirements to the canned motor pump for cooling water circulation: medium: Demineralized water, operating temperature 320/sup 0/C, operating pressure 155 bar, radiation field of the reactor, integration in the irradiation capsule, helium leak rate < 10/sup -6/mbar.dm/sup 3/.s/sup -1/, minimum working life 3000 hours, were high and caused difficulties in the acquisition of this component. First test runs with supplied pumps showed that the desired working life could not be achieved. The results of the development steps, the test runs, and the performance in service show that for our range of applications, the best combination of materials for the radial bearings is silicon-infiltrated SiC (8% free Si) against the same material. These bearings allowed a good working life for the pump to be achieved.

19580 (INIS-BR—1411, pp 61-72) **Activity flow in an Angra 2 type PWR nuclear power plant.** Dias, W.B. (NUCLEN, Rio de Janeiro, RJ (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

This paper presents the noble gas and iodine activity contents of some important systems and components of an Angra 2 - type plant. The activities are derived by means of a model calculation which assumes equilibrium concentrations in the primary coolant for a specified set of operating conditions. The bases for deriving the primary coolant activities are the activity release rates from the fuel. An activity release rate is assigned to one leading nuclide in each group (i.e. Xe133 and I131) and for the remaining nuclides within a group the release rates are calculated according to the difusion model. The activity concentrations in the primary coolant calculated on the basis of these release rates yield typical values as demonstrated by inumerous measurements carried out in operating plants.

19581 **(INIS-mf—11395) Operational safety of nuclear installations, Netherlands, Borssele, 6-10 April, 1987. Report to the government of the Netherlands.** ; IAEA - PZEM Borssele kerncentrale Collaboration. (International Atomic Energy Agency, Vienna (Austria)). 10 Apr 1987. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706090/JAW.

The OSART team observed the increased supervision during shift operations and noticed a positive impact due to increased management presence in the plant. No discrepancies or instances of questionable safety system status was found. The completion of these post OSART long term projects will more clearly identify and formalize some of the processes in the plant in order to continue to assure that the Borssele plant will continue to be operated safely.

19582 (INIS-mf—11896, pp 3.1-3.21) **Results of measurements on steam generator tubes with a new computer aided multifrequency eddy current prototype.** Betzold, K.; Becker, R. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Defect detection capacity and signal analysis for size and type of defect are to be improved, in particular, for the examination of tube bottom and rolled joint. The method concept is based on three major features: (1) The complex signal pattern of the interfering parts is considered by a nonlinear description and integration with the algorithm for interference noise elimination; (2) noise-eliminated defect signals are classified in the two-dimensional plane while assigning the angle position of defect signals to the causative defect type, and the amplitude to the defect size; (3) information contained in signal dynamics of noise-suppressed defect signals is used additionally to support evaluation in the classification plane.

19583 (INIS-mf—11896, pp 11.1) **Advances arising from the UK PWR programme in the detection and sizing of defects.** Gardner, W.E.; Whittle, M.J. (UKAEA Risley Nuclear Power Development Establishment). 1986. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

19584 (INIS-mf—11897, pp 26.1-26.29) **Advances in PWR structural integrity assessment and materials technology in the United Kingdom.** Darlaston, B.J.; Gardner, W.E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.; UKAEA Risley Nuclear Power Development Establishment). 1986. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The U.K. PWR structural integrity and materials programme is considered under four headings; an overview of the programme, the focal points in some recent achievements and finally future work and facilities. This collaborative programme is being undertaken in the main by the UKAEA and the CEGB. The work is classified into five topic areas: Fracture properties and testing procedures, metallurgical studies, environmentally assisted cracking, fabrication and repair, integrity methods and validation. The programme is related to the requirements of the project and also depends upon collaboration and exchanges with programmes elsewhere.

19585 (INIS-mf—11897, pp 29.1-29.17) **Bursting behaviour of a 15 NiCuMoNb 5 feedwater pipe.** Gnirss, G.; Tolksdorf, E.; Gerner, M. (Asea Brown Boveri A.G., Mannheim (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

During the hot trial operation II of the Muelheim-Kaerlich nuclear power plant, a rupture of the feedwater line occurred in the piping system between isolation valve and non-return valve. Damage was caused by inadmissible pressure build-up as a result of trial-related long-term heat input into the water-filled pipeline section shut off tightly by two valves. Damage corresponded to a fracture through strength failure of a WB 36 pipeline with the fracture exiting in the base metal. Fracture areas angled 45/sup 0/ to the surface and showed the honey-comb structure typical of shear stress. No indications for material or processing defects were found.

19586 **(KAERI/RR—691/87) Development of flow test technology for PWR fuel assembly.** Chung, Moon Ki; Cha, Chong Hee; Chung, Chang Hwan; Chun, Se Young; Song, Chul Hwa; Chung, Heung Joon; Won, Soon Yeun; Cho, Yeong Rho; Kim, Bok Deuk. (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). May 1988. 315p. (In Korean). NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS. Order Number DE88706101/JAW.

KAERI has an extensive program to develope PWR fuel assembly. In relation to the program, development of flow test technology is needed to evaluate the thermal hydraulic compactibility and mechanical integrity of domestically fabricated nuclear fuels. A high-pressure and high-temperature flow test facility was designed to test domestically fabricated fuel assembly. The test section of the facility has capacity of a 6x6 full length PWR fuel assembly. A flow test rig was designed and installed at Cold Test Loop to carry out model experiments with 5x5 rod assembly under atmosphere pressure to get information about the characteristics of pressure loss of spacer grids and velocity distribution in the subchannels. LDV measuring technology was established using TSI's Laser Dopper Velocimeter 9100-3 System.

19587 **(KFK—4460) Observations on processing neutron nuclear data from the JEF-1 fundamental cross section library with the Karlsruhe version of the processing system NJOY.** Mateeva, A. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). Nov 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756964/JAW.

During the generation of a new group constant set for application in PWR fuel cycle analysis, many irregularities in the group cross sections and selfshielding factors were observed. As the fundamental cross section library the Joint Evaluated File JEF-1 was used, the processing of these data to group constants was performed with the Karlsruhe version of the processing system NJOY. Most of the irregularities occur for high concentration of the nuclide in question, especially in the unresolved resonance region. The irregularities are discussed in some detail and possible reasons for their occurrence are given. This investigation is done for all group cross sections of the heavy nuclei (U-232, -234, -235, -236, -238, Pu-238, -239, -240, -241, -242, Am-241, -243), structural materials, oxygen, boron, and hydrogen bound in water. All irregularities are removed, partly formally. The application of this new group constant library to the analysis of the PWR-fuel cycle will be described in another paper.

19588 **(KFKI—1988-34/G,M) Part-task simulator for a WWER-440 nuclear power plant subsystem.** Szabo, B.K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1988. 27p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705569/JAW.

PC-based part-task simulators for simulating subsystems of nuclear power plants are low cost tools for operator training. In the

Central Research Institute for Physics, Budapest, a simulator system has been developed to facilitate fast development of such simulators. The first application simulates the Neutron Flux Monitoring System of WWER-440 nuclear power plants. (author) 9 refs.; 2 figs.

19589 **(KFKI—1988-44/G) Instructor support and malfunction handling in the WWER-440 Basic Principles Simulator.** Gacs, A.; Szabo, G.; Vegh, E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1988. 23p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705571/JAW.

This research is part of the coordinated research program on 'Development of common modelling approaches for nuclear power plant training simulators' of the International Atomic Energy Agency. A Basic Principles Simulator for WWER-440 nuclear power reactors has been completed in the Central Research Institute for Physics, Budapest. The instructor plays a significant role when a training simulator is used for educating a complex technological process. The Instructor System of the simulator is described. A screen driven system was developed for providing a simple yet powerful tool to control the running of this simulator. One of the most complex problems is malfunction control of a reactor, therefore this case is treated in the Instructor System description. (R.P.) 5 figs.

19590 **(KFKI—1988-46/G) Modelling approaches for a Basic Principles Simulator for WWER-440 (PWR) nuclear power plants.** Janosy, J.S.; Kiss, Zs.; Gacs, A.; Vegh, E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1988. 25p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705572/JAW.

This research is part of the coordinated research program on 'Development of common modelling approaches for nuclear power plant training simulators' of the International Atomic Energy Agency. The development of the dynamic models of a WWER-440 nuclear power plant has been completed in the Central Research Institute for Physics, Budapest. These models are to be used in a Basic Principles Simulator. This paper describes the general aspects and the most important features of the dynamic models and it summarizes the results obtained during the development. (author) 7 refs.

19591 **(NUREG—1343) Technical Specifications: Vogtle Electric Generating Plant, Unit Nos. 1 and 2 (Docket Nos. 50-424 and 50-425): Appendix "A" to License Nos. NPF-68 and NPF-79.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1989. 469p. NTIS, PC A20/MF A01 - GPO - OSTI. Order Number TI89008094/JAW.

The Vogtle Electric Generating Plant, Unit Nos. 1 and 2, Technical Specifications were prepared by the US Nuclear Regulatory Commission to set forth the limits, operating conditions, and other requirements applicable to a nuclear facility as set forth in Section 50.36 of 10 CFR 50 for the protection of the health and safety of the public.

19592 **(NUREG/CR—5116) Survey of PWR water chemistry.** Gorman, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Argonne National Lab., IL (USA)). Feb 1989. Contract W-31109-ENG-38. 137p. (ANL—88-43). NTIS, PC A07/MF A01 - GPO - OSTI. Order Number TI89007722/JAW.

This report surveys available information regarding primary and secondary water chemistries of pressurized water reactors (PWRs) and the impact of these water chemistries on reactor operation. The emphasis of the document is on aspects of water chemistry that affect the integrity of the primary pressure boundary and the radiation dose associated with maintenance and operation. The report provides an historical overview of the development of primary and secondary water chemistries, and describes practices currently being followed. Current problems and areas of research associated with water chemistry are described. Recommendations for further research are included. 183 refs., 9 figs., 19 tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 19640, 20560, 20567

19593 **(MRP—88/1) Managing macro projects - an emerging discipline?.** Morris, P.W.G. (Templeton Coll., Oxford Centre for Management Studies (UK)). Jan 1988. 52p. Templeton College, Oxford Centre for Management Studies, Oxford. Price Pound 3.20.

The paper examines the management of large scale projects, and includes the management of the United Kingdom Advanced Gas Cooled Nuclear Reactor (AGR) programme. A description is given of the development of this programme, including:- the adoption of the AGR design, construction of the early AGRs, problems with the AGRs, project overrun, and the philosophy in planning Heysham 2. The lessons to be learnt from the management of the U.K. AGR power project are discussed, and a framework for analyzing large scale projects is presented. (U.K.).

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 19604

19594 **(CONF-881011—40) Fuel-sodium reaction product formation in breached mixed-oxide fuel.** Bottcher, J.H.; Lambert, J.D.B.; Strain, R.V.; Ukai, S.; Shibahara, S. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007383/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The run-beyond-cladding-breach (RBCB) operation of mixed-oxide LMR fuel pins has been studied for six years in the Experimental Breeder Reactor-II (EBR-II) as part of a joint program between the US Department of Energy and the Power Reactor and Nuclear Fuel Development Corporation of Japan. The formation of fuel-sodium reaction product (FSRP), Na_3MO_4, where M = U/sub 1-y/Pu/sub y/, in the outer fuel regions is the major phenomenon governing RBCB behavior. It increases fuel volume, decreases fuel stoichiometry, modifies fission-product distributions, and alters thermal performance of a pin. This paper describes the morphology of Na_3MO_4 observed in 5.84-mm diameter pins covering a variety of conditions and RBCB times up to 150 EFPD's. 8 refs., 1 fig.

19595 **(CTA-IEAV-NT—015/86) Superenergy-2; use and validation.** Braz Filho, F.A.; Luz, M.; Borges, E.M.; Hirdes, V.R. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Sep 1986. 14p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705424/JAW.

SUPERENERGY-2 is a code used to study the whole core thermal-hydraulic behaviour in LMFBR type reactors. The purpose of this work is to verify the capabilities of the code in such analyses. The results obtained were satisfactory when compared to theoretical and experimental data, and they confirm SUPERENERGY-2 to be an efficient code for the thermal design of these reactors.

19596 **(OEFZS-A—1309) Energy situation and future options. Under special consideration of renewable energy sources.** Faninger, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Nov 1988. 545p. (In German). (NU—81/88). the Austrian Research Centre Seibersdorf, A-2444 Seibersdorf (Austria).

Limited Distribution.

The development of energy economy. Energy resources, energy conversion and energy storage. State of the art of renewable energy technologies and future aspects. Energy carrier hydrogen. Non-technical aspects. Paths to future energy systems. Chapter 3.8 (pp 154-160) is on the fast breeder and fusion. 102 refs., 282 figs.

19597 **(UJV—8397-T) Calculation of flow through BN type fuel assembly for the case of deformed geometry due to displacement of individual rods in laminar approximation.** Schmid, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Jun 1988. 35p. (In Czech). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705600/JAW.

The finite element method was used for calculating the laminar flow in a BN type fuel assembly, this both for the rated geometry and for deformed geometry brought about by displacement of a rod. Calculations were carried out for the rod displacement in the central, lateral and corner areas of the assembly to all characteristic directions, this always a displacement of 25, 50, 75 and 98% of the maximum possible value (contact with adjacent rod). The displacement was considered in the direction of the axis, and in the direction of a 30 deg angle in the space between two neighbouring rods. For lateral and corner areas the calculations were made for cases with spacing rods and without; a total of 5 geometries were studied. On the basis of the results obtained, formulas were suggested for the five cases for the rapid determination of the shape coefficient and of the laminar geometric factor of flow in dependence on rod size and direction of rod displacement. The results of the calculations are presented in a great number of tables and graphs. (A.K.). 33 figs., 11 tabs., 11 refs.

19598 **Statistical evaluation of light water reactor piping damping data for use in PRA analyses.** Ware, A.G. (Idaho National Engineering Lab., Idaho Falls, ID (US)). pp 61-70 of Damping - 1988. Hara, F.; Chen, P.Y.; Chen, S.S.; Ware, A.G. New York, NY; American Society of Mechanical Engineers (1988). (CONF-8806222—).

From Damping 1988; Pittsburgh, PA, USA (19 Jun 1988).

This paper presents the results of studies used to quantify, on a statistical basis, one of the parameters (piping system camping) input to probabilistic risk assessment (PRA) analyses of nuclear structures. Damping data were selected from tests in which the piping had been vibrated at levels representative of at least moderate severity seismic or hydrodynamic transients. These data, representing 27 light water reactor type piping systems, formed the basis for the statistical damping study. Most of these systems were actual nuclear power plant systems, and the lowest mode was < 8 Hz in over 80% of the systems. Damping was treated as independent of frequency (or mode number). The statistical analysis showed that a lognormal probability fit provided a suitable approximation of the raw data. For the cases in which all data were considered (which allowed duplicate tests for each system to be included so that the overall data were biased by those systems with the most data), mean lognormal damping values ranged from 2.68% to 3.55% of critical. When duplicate tests were eliminated, the means ranged from 3.12% to 3.72% of critical. For the final cases, which considered only the lowest mode at its highest excitation level, mean lognormal damping values ranged from 3.28% to 6.50% of critical.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 19440, 19807, 19808

19599 **(ANSP-M—19) Reentry response of the light weight radioisotope heater unit resulting from a Venus-Earth-Earth Gravity Assist maneuver accident.** Hagan, J.C. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). Oct 1988. Contract AI01-88NE32140. 141p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005359/JAW.

Reentry analyses consisting of ablation response, thermal response and thermal stress response have been conducted on the Light Weight Radioisotope Heater Unit for Galileo/VEEGA reentry conditions. Sequential ablation analyses of the LWRHU aeroshell, the fuel clad, and the fuel pellet have been conducted in reentry regimes where the aeroshell has been deemed to fail. The failure criterion for ablation is assumed to be recession corresponding to 50% of the wall thickness (the design criterion recommended in the DOE Overall Safety Manual). Although the analyses have been carried far beyond this limit (as presented and discussed herein), JHU/APL endorses the position that failure may occur at the time that this recession is achieved or at lower altitudes within the heat pulse considering the uncertainties in the aerodynamic, thermodynamic, and thermo-structural analyses and modeling. These uncertainties result mainly because of the high energies involved in the VEEGA reentries compared to orbital decay reentries. Risk evaluations should consider the fact that for shallow flight paths the unit may disassemble at high-altitude as a result of ablation or may remain intact until it impacts with a clad that had been molten. 80 refs., 46 figs., 16 tabs.

19600 **(PNL-SA—15971) Thermal and dynamic analysis of the RING [Radiatively-cooled, Inertially-driven Nuclear Generator] power system radiator.** Apley, W.J.; Babb, A.L. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 5p. (CONF-890103—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007236/JAW.

From 6. symposium on space nuclear power systems; Albuquerque, NM, USA (9 Jan 1989).

The nuclear option for a space-based power system appears most suitable for missions that require long-term, sustained operation at power levels above 100 kWe. Systems currently available operate at relatively low thermal efficiencies (6--10%). Thus, a 100 kWe system must discharge nearly 2 MWth of waste heat through the comparatively inefficient process of radiative cooling. The impact of the resultant radiator assembly size on overall power system weight is significant, and has led to proposals for radiators with potentially higher efficiencies. Examples include the: liquid droplet radiator; fabric radiator; bubble membrane radiator; rotating film radiator; and dust radiator. 14 refs., 2 figs., 2 tabs.

19601 **The two-coil toroid magnet - An option for ASTROMAG.** Green, M.A.; Gasini, G.; Ricci, M.; Codino, A.; Spillantini, P.; Rosetelli, F. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1015-1018(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The ASTROMAG particle astrophysics experiment for the space station requires large magnetic field integrals in order to separate a high z, high energy isotopes. The two-coil toroid is a magnet configuration which can provide the desired field integral. The two-coil toroid will produce a magnetic field with zero net dipole moment which is required for operation on the space station. Magnetic fields as high as 5 T can be generated within a useful part of the experiment using this configuration. This paper presents a low mass zero mechanical moment two-coil toroid which could be launched by the space station. The magnet design presented in this paper will be cooled using pumped helium II at about 1.8 K. The proposed cryogenic system would operate for up to 2 years on a single load of liquid helium II. The ASTROMAG cryogenic system is designed for helium resupply from the shuttle.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 19676

19602 **(INIS-BR—1417) Industrial radiation protection: what it is happening.** Endo, M. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 7p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705740/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

This paper presents the standard NE-06.04 of CNEN (Comissao Nacional de Energia Nuclear - Brazil) about open and close industrial radiography installations licensing. This review does not substitute CNEN-6/73 resolution, only specificy in details, how those installations must actuate with reference to the company radiation protection plan. (C.M.).

2108 Economics

REFER ALSO TO CITATION(S) 19681

19603 (INIS-mf—11360) Facts and figures. A graphical analysis of world energy up to 1987. Anon. (Organization of the Petroleum Exporting Countries (OPEC), Vienna (Austria)). 1988. 34p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706058/JAW.

Items 1,2 on primary energy consumption by type, and item 13 on proven recoverable conventional energy resources contain information on the weight of nuclear energy and uranium relative to other energy sources. Item 18 on nuclear power informs on the number and the power of nuclear power plants, in DC's, CPE's and industrialized countries. (qui).

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 19671

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 19427, 19610, 19635

19604 (KFK—4435) Fast reactor cell code KAPER4. Boehme, R.; Fischer, E.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1988. 121p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757150/JAW.

This report describes the code KAPER4, a multigroup code for neutronics calculations of heterogeneous lattices of fast reactors. The code solves the integral transport equation with isotropic scattering by a collision probability formalism. Though restricted to one dimension, the code can handle both pin cells of a fast reactor, and plate cells of heterogeneous critical facilities. The method, including the treatment of resonance self-shielding based on the f-factor concept, is explained in detail. A description of the program structure and an input description are given. The code calculates eigenvalues, fluxes, and reaction rates. It has several additional capabilities, which are also described.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 19645, 19873, 19888, 19890, 19892, 19893, 19969, 20295, 20296, 20302, 20303, 20306, 20307, 20308, 20309, 20313

19605 (IAEA-TECDOC—478) Component reliability data for use in probabilistic safety assessment. (International Atomic Energy Agency, Vienna (Austria)). Oct 1988. 297p. NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS. Order Number DE88705462/JAW.

Generic component reliability data is indispensable in any probabilistic safety analysis. It is not realistic to assume that all possible component failures and failure modes modeled in a PSA would be available from the operating experience of a specific plant in a statistically meaningful way. The degree that generic data is used in PSAs varies from case to case. Some studies are totally based on generic data while others use generic data as prior information to be specialized by plant specific data. Most studies, however, finally use a combination where data for certain components come from generic data sources and others from Bayesian updating. The IAEA effort to compile a generic component reliability data base aimed at facilitating the use of data available in the literature and at highlighting pitfalls which deserve special consideration. It was also intended to complement the fault tree and event tree package (PSAPACK) and to facilitate its use. Moreover, it should be noted, that the IAEA has recently initiated a Coordinated Research Program in Reliability Data Collection, Retrieval and Analysis. In this framework the issues identified as most affecting the quality of existing data bases would be addressed. This report presents the results of a compilation made from the specialized literature and includes reliability data for components usually considered in PSA.

19606 (INIS-mf—11896, pp 4.1-4.19) Nondestructive testing of welds with the EMAG-analyzer. Theiner, W.A.; Deimel, P. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.); Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The authors demonstrate possible applications of magnetic Barkhausen noise in the measurement of hardness and residual stresses in welds. Tests were performed on the materials 22NiMoCr37 and WB 35 using the EMAG analyser developed at IzfP. The (M/sub MAX/, H/sub CM/)-value pairs (M/sub MAX/: Maximum of rectified magnetic Barkhausen noise amplitude; H/sub CM/: coercitive field strength derived from noise curve) were recorded as a signal location curve on a recorder; in addition, the (M/sub MAX/, H/sub CM/)-values were documented on a plotter. The sensor was guided manually.

19607 (INIS-mf—11897, pp 28.1-28.13) Monitoring of pressure pulsation and flow induced vibrations in piping systems. Kremer, S.; Schultz, M. (Asea Brown Boveri A.G., Mannheim (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Pipeline systems of power plants are designed to stand pressure surge loads. Design is based on a service life analysis which allows specific maximum values of pressure and oscillation amplitudes. A computer-aided monitoring and recording system was designed and constructed to verify that those values are met in the initial phase of operation. The measurement system comprises 16 signal channels whose number may be extended to 32.

19608 (JAERI-M—88-196) Visual observation of a heat pipe working characteristics. Tsuyuzaki, Noriyoshi; Saito, Takashi; Ishigami, Shinya; Kawada, Michitaka; Konno, Masanobu; Kaminaga, Fumito; Okamoto, Yoshizo. (Japan Atomic Energy Research Inst., Oarai, Ibaraki. Oarai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 43p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756913/JAW.

When the heat pipe is used in a nuclear engineering field, it is indispensable to understand transient characteristics of an accident condition as well as in a steady state at a normal operation. However there have been few informations about the transient characteristics of a heat pipe in case of rapid temperature or heat load change in an evaporator section. The purpose of this study is to examine transient and steady state characteristics of a gravity assisted heat pipe and variable conductance heat pipe(VCHP) which will be used in a neutron irradiation capsule. This report presents results of visual observation of boiling and condensation patterns on steady state or transient condition in a visible heat pipe made of a glass. The response time of the heat pipe is on the order of a few seconds when the temperature of the evaporator part is kept above the operating temperature.

19609 (STU—85-5404, pp 59-63) Corrosion problems in PWR steam generators - A review. Norring, K. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Steam generators in pressurized water reactors are designed to last the lifetime of the reactor. However, steam generators have experienced damages which have significantly affected their reliability. More than 90% of the tube failures are caused by some form of corrosion (for instance wastage, denting, intergranular stress corrosion cracking, intergranular corrosion, and pitting). At

Ringhals 2, and at least seven other units, the magnitude of the corrosion problems has lead to a decision to replace the steam generators.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 19654, 20734

19610 **Recent advances in high temperature thermocouples.** Cannon, C.P. (Westinghouse Hanford Co. (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

Thermocouples capable of operation at temperatures above 2500°C have been fabricated to measure fuel centerline temperatures. Rhenium is used as the sheath material and hafnia as the insulator material. The thermocouples are 1.5 mm in diameter and contain W5%Re/W26%Re thermoelement wires. A small diameter stainless steel sheathed compensating lead cable containing a fission gas barrier ceramic-to-metal seal is spliced to the thermoelement probe.

2204 Control Systems

REFER ALSO TO CITATION(S) 19402, 19421, 19592, 19607, 19638, 20138

19611 **(ANL/PPRNT—89-104) Programming for a nuclear reactor instrument simulator.** Cohn, C.E. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008402/JAW.

A new computerized control system for a transient test reactor incorporates a simulator for pre-operational testing of control programs. The part of the simulator pertinent to the discussion here consists of two microprocessors. An 8086/8087 reactor simulator calculates simulated reactor power by solving the reactor kinetics equations. An 8086 instrument simulator takes the most recent power value developed by the reactor simulator and simulates the appropriate reading on each of the eleven reactor instruments. Since the system is required to run on a one millisecond cycle, careful programming was required to take care of all eleven instruments in that short time. This note describes the special programming techniques used to attain the needed performance.

19612 **(CONF-890361—1) Evaluation of time delay requirements for closed-loop stability using classical and modern methods.** Murphy, G.V.; Bailey, J.M. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering). 1989. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006417/JAW.

From 21. Southeastern symposium on system theory (SSST '89); Tallahassee, FL, USA (26 Mar 1989).

This paper uses classical and modern methods for computing the maximum allowable time delay a closed-loop system can tolerate before destabilizing. Maximum allowable time delays are computed using both methods for three control systems previously designed for a simple process. The three control systems are proportional plus integral (PI), linear quadratic Gaussian (LQG), and linear quadratic Gaussian with loop transfer recovery (LQG/LTR). The allowable time delays obtained from the modern method are compared with the results of the well established classical method for single input-single output (SISO) systems. 5 refs., 4 figs., 5 tabs.

19613 **(KURRI-TR—307) Complete reconstruction of all annunciator panels and their auxiliary facilities at central regulation office in KURRI.** Ishihara, Shinji; Kimura, Yasuhiro; Nakamura, Hiroshi; Nishino, Kunihiko; Higashiyama, Yukihiro; Okamoto, Ken-ichi; Maki, Hirotoshi; Kimura, Itsuro. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Aug 1988. 37p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756924/JAW.

At the Research Reactor Institute of Kyoto University (KURRI) which is a joint research center with Kyoto University Reactor KUR and so forth for nation-wide universities, most of important alarm signals from KUR, KUCA and other radiation facilities are concentrated at the central regulation office. Although the function of this office had been kept normal for more than 20 years, it became necessary to reconstruct all of its annunciator panels in order to add new alarm systems, for example a newly built spent fuel storage building and a newly installed cold neutron source in KUR, and to improve the functions of old alarm systems. Thereupon, all of the annunciator panels of this office together with their auxiliary facilities were completely reconstructed in the fiscal year of 1985. Furthermore the room of this office was enlarged and reconstructed thoroughly, since it was rather narrow and inconvenient before. This report describes the reconstruction work in detail: (1) Function of the central regulation office, (2) Outline of this work, (3) Design concept, (4) Method and special cares, (5) Reconstruction of the room, (6) New utility tunnels for cables, (7) Configulation and structure of new annunciator panels, (8) Cables and their reconnection, (9) Annunciator circuits, (10) Function of each panel, (11) Test and performance, and (12) concluding remarks and future plans. This experience may be useful for the case of reconstruction of the control desk and instrumentation panels of KUR in future.

19614 **(NUREG/CR—5234) Value/impact analysis for Generic Issue 51: Improving the reliability of open-cycle service-water systems.** Daling, P.M.; Stiles, D.L.; Weakley, S.A.; Johnson, K.I. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 125p. (PNL—6668). NTIS, PC A06/MF A01 - GPO - OSTI. Order Number TI89007672/JAW.

The value/impact analysis undertaken in this study indicates that implementing a basic surveillance and control program at nuclear power plants would provide a reduction in public health risk for acceptable costs. A basic program would include continuous chlorination of the open-cycle service-water systems to control biofouling, and periodic flushing and flow-testing of safety-related heat exchangers cooled by the service-water system to control fouling by sediment and corrosion products. Implementation of more comprehensive fouling programs was shown to reduce public health risks only slightly more than the basic program but was shown to increase costs dramatically. These are the primary conclusions that were derived in this report, which is a value/impact analysis of alternative fouling surveillance and control programs. The results of these studies have been published in a series of reports that provide the technical basis for development of proposed fouling programs and estimates of the values and impacts associated with their implementation by the nuclear industry. 31 refs., 4 figs., 28 tabs.

19615 **(ORNL/TM—10916) Robust control technique for nuclear power plants.** Murphy, G.V.; Bailey, J.M. (Oak Ridge National Lab., TN (USA)). Mar 1989. Contract AC05-84OR21400. 74p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007872/JAW.

This report summarizes the linear quadratic Guassian (LQG) design technique with loop transfer recovery (LQG/LTR) for design of control systems. The concepts of return ratio, return difference, inverse return difference, and singular values are summarized. The LQG/LTR design technique allows the synthesis of a robust control system. To illustrate the LQG/LTR technique, a linearized model of a simple process has been chosen. The process has three state variables, one input, and one output. Three control system design methods are compared: LQG, LQG/LTR, and a proportional plus integral controller (PI). 7 refs., 20 figs., 6 tabs.

19616 **The development of an intelligent nuclear maintenance robot.** Mann, R.C.; Hamel, W.R.; Weisbrin, C.R.; Lee, C.S.G. (Oak Ridge National Lab., Oak Ridge, TN (US); School of Electrical Engineering, Purdue Univ., West Lafayette, IN (US)). pp v of Proceedings of the 1988 IEEE international conference on robotics and automation. Volume 1. Piscataway, NJ; IEEE Service Center (1988). (CONF-880424—).

From IEEE international conference on robotics and automation; Philadelphia, PA, USA (24 Apr 1988).

The U.S. Department of Energy has provided support to four universities and the Oak Ridge National Laboratory (ORNL) in order to pursue research leading to the development and deployment of robotic system(s) for advanced nuclear power stations. This paper describes the scope of the program and the R and D effort contributed by ORNL.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 20542, 20550, 20561, 20562, 20563, 20564, 20569, 20570, 20572, 20573, 20574, 20577, 20578, 20580, 20581, 20590, 21322

19617 **(EPRI-NP—5676) Below Regulatory Concern Owners Group: An evaluation of dry active waste sorting: Final report.** Casey, S.M. (Electric Power Research Inst., Palo Alto, CA (USA); Anacapa Sciences, Inc., Santa Barbara, CA (USA)). Feb 1989. 75p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008413/JAW.

The objective of this research was to determine the accuracy of manual inspection of Dry Active Waste (DAW). Three studies were conducted at two nuclear power plants in which unmodified DAW waste streams of roughly 10,000 items each were inspected by technicians using pancake probes. Sorting performance was measured unobtrusively by intercepting the "outflow" from inspection stations. Verification of sorting accuracy was performed with a prototype, semi-automated sorting table employing a matrix of fixed plastic scintillation detectors. More than 30,000 items of trash were examined, classified, counted, and verified, and the composition of the "inflow" to the inspection stations was determined by reconstructing the "outflow" components, as determined during verification procedures. The results showed that between 1 and 19% of all items in each of the three DAW waste streams were contaminated at levels $\geq$100 ccpm. Sixty-two percent of the "contaminated" items in Study I, 87% of the contaminated items in Study II, and 97% of the contaminated items in Study III were detected. One-half to one percent of all items classified as $<$100 ccpm by technicians were actually $\geq$100 ccpm. False positive rates were very high in all three studies. The production rates and accuracy obtained on the semi-automated plastic scintillation sorting table used during the verification stages of this project greatly exceeded the rates for manual sorting. 9 figs., 13 tabs.

19618 **(EPRI-NP—6191) Testing and analyses of the TN-24P PWR spent-fuel dry storage cask loaded with consolidated fuel.** McKinnon, M.A.; Michener, T.E.; Jensen, M.F.; Rodman, G.R. (Electric Power Research Inst., Palo Alto, CA (USA); Pacific Northwest Lab., Richland, WA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1989. Contract AC06-76RL01830;AC07-76ID01570. 219p. (PNL—6631). NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007467/JAW.

A performance test of a Transnuclear, Inc. TN-24P storage cask configured for pressurized water reactor (PWR) spent fuel was performed. The work was performed by the Pacific Northwest Laboratory (PNL) and Idaho National Engineering Laboratory (INEL) for the US Department of Energy Office of Civilian Radioactive Waste Management (OCRWM) and the Electric Power Research Institute. The performance test consisted of loading the TN-24P cask with 24 canisters of consolidated PWR spent fuel from Virginia Power's Surry and Florida Power & Light's Turkey Point reactors. Cask surface and fuel canister guide tube temperatures were measured, as were cask surface gamma and neutron dose rates. Testing was performed with vacuum, nitrogen, and helium backfill environments in both vertical and horizontal cask orientations. Transnuclear, Inc., arranged to have a partially insulated run added to the end of the test to simulate impact limiters. Limited spent fuel integrity data were also obtained. From both heat transfer and shielding perspectives, the TN-24P cask with minor refinements can be effectively implemented at reactor sites and central storage facilities for safe storage of unconsolidated and consolidated spent fuel. 35 refs., 93 figs., 17 tabs.

19619 **(INIS-BR—1397) Central nuclear almirante Alvaro Alberto: study on the phytoplanktonic variation in the region of unity 1 - Angra dos Reis - RJ.** Souza, C.A.F. de; Pessoa, M.A.R.; Utchitel, S. (Fundacao Estadual de Engenharia do Meio Ambiente, Rio de Janeiro, RJ (Brazil)). [1988]. 41p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705510/JAW.

By according of "staff" which has elaborated the first works in phytoplankton, in initial phasis (before operation) of Central Nuclear Almirante Alvaro Alberto - CNAAA Unidade 1, Angra dos Reis, Rio de Janeiro, Brazil we carry out a search about physic - chemicals parameters at same area, during the times of 11 months, too. The efluent region presents a phytoplanktonic comunity of reasonable environmental conditions. The evaluation of biological parameters, or in the words, a natural environment in equilibrium.

19620 (INIS-BR—1411, pp 8-18) **Control, evaluation, filing and reporting of gross α and β at Environmental Engineering Division - DIEAN.CN of NUCLEBRAS Research Center - CDTN.** Carvalho, M.A.G. de. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The Environmental Engineering Division - DIEAM.CN of NUCLEBRAS research center - CDTN, routinely performs environmental analyses by alpha and beta counting using proportional detectors. The results are used in the management and in the issuing of reports for the Environmental Surveillance Programs under the responsability of the Division. This paper describes the system used for the processing, filling and result emission for gross α and gross β analyses. The system was developed in BASIC language and using the software dBase II. At the radiometry laboratory, an Apple 2e microcomputer - with 12 kbytes of memory, monitor, two disk drives and an Epson FX.100/sup +/ printer - has been in use since June 87 for the processing of these data.

19621 (INIS-BR—1411, pp 19-29) **Quality control in the low activity radioanalytical laboratory of the Environmental Division, DIEAM.CN of NUCLEBRAS Research Center - CDTN.** Carvalho, M.A.G. de. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The Environmental Engineering Division - DIEAM.CN of NUCLEBRAS research center - CTDN, is in charge of the routine work related to the analysis of environment samples collected at several NUCLEBRAS facilities. This paper presents the procedures used for quality control of the analyses performed at the Laboratory. The samples are initially verified and recorded as soon as they arrive at the Division. From then on, each aliquot and each analysis will be controlled using a follow-up sheet. Once a year, the operational conditions of the Lab couting systems are verified thoroughly. At that time, the systems are calibrated using certified radioactivity standards. Performance of the detectors is checked using control graphs, which can indicate the need for specific procedures to be followed such as maintenance, decontamination or recalibration. In order to reduce the risk of mistakes and to increase the capacity for global data evaluation, a microcomputer is used for processing the counting data and for editing a final report.

19622 (INIS-BR—1411, pp 331-343) **Strategy of environmental measurements in case of nuclear incidents and accidents.** Winter, M.; Narrog, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.); Ministerium fuer Unwelt Baden - Wuerttemberg (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Routine work and tasks related to prevention in environmental monitoring of nuclear facilities range from low level metrology to the necessity of being likewise prepared to perform environmental impact measurements after nuclear incidents and accidents. The ranges of radioactivity and dose measurements defined by this requirement cover several orders of magnitude. For this reason, different measurement programs must be defined for different action levels (dose ranges). An emergency measuring program should discriminate between immediate measures and long-term to be taken at a later stage and at greater distances from the nuclear facility. Such a program should take into account which decision making groups need which information to order adminitrative measures. It is of importance in this context which measured results can be available at which point of time, which results are expected as instantaneous results from mobile systems obtained during measurements trips and which measurements must be performed in stationary laboratories on samples collected at an early stage. A concept of environment monitoring measures graded in time and space is proposed.

19623 (INIS-BR—1411, pp 239-252) **Environmental monitoring at CNEN/Sao Paulo.** Mazzilli, B. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

In order to evaluate the radiological impact due to the operation of the nuclear facilities available at CNEN/Sao Paulo an environmental monitoring program is carried out. This program was established in order to assure that under normal operation conditions the radioactive effluents generated will not give rise to radiation exposures of members of the public in excess of those stipulated by competent authorities. The program comprises a continuous monitoring of all the radioactive liquid and gaseous effluents generated at CNEN/Sao Paulo, and the measurement of the artificial and natural radionuclide concentration in aquatic, terrestrial and atmospheric samples in the surrounding of the nuclear facilities. Besides, external gamma radiation background in the environment is measured by using thermoluminescent dosimeters.

19624 (INIS-BR—1411, pp 166-172) **Dose assessment under incidental and accidental conditions.** Huebschmann, W.G. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Meterologie und Klimaforschung). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Dose assessment for the licesing process of a nuclear power plant covers the routine release of radioactive substances into the atmosphere as well as releases due to incidents. Source terms for these incidents are evaluated by the detailed incident analysis of the plant. The types of incidents to be covered are determined in the FRG by the "Stoerfall-Leitlinien" of the Ministry of the Interior. The calculation of dose equivalents in the environment of the plant differs from the calculation of doses due to routine releases, as incidents are single events occuring at undeterminate time, and the results must be conservative. Some details are being described. During the operation of the plant it is essential to measure not only the radioactivity release rates but also the necessary meteorological parameters for the instantaneous determination of the atmospheric dispersion in case of incidental or accidental releases of radioactivity. This instantaneous assessment assists in taking measurements of ground contamination and in deciding about countermeasures for the protection of plant personnell and population.

19625 (JAERI-M—88-206) **Computer code 'WAGEN' for the generation of artificial earthquake ground motions.** Fujita, Shigeki; Baba, Osamu; Suzuki, Takehiro. (Japan Atomic Energy Research Inst., Oarai, Ibaraki. Oarai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 24p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756918/JAW.

WAGEN is a computer code for the generation of artificial Earthquake Ground Motions utilized for the aseismic design of nuclear power facilities. WAGEN is developed on the basis of the procedure proposed by Dr. Ohsaki. An artificial earthquake ground motion generated in such a way that the response spectrum shows good fitting to the design response spectrum. This report presents main features, numerical procedure, manual of the code and an example of usage.

19626 (NUREG/CR—5250-Vol.1) **Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Methodology, input data and comparisons to previous results for ten test sites.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 350p. (UCID—21517-Vol.1). NTIS, PC A15/MF A01 - GPO - OSTI. Order Number TI89007723/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume. Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 1, provides an overview of the methodology developed to incorporate the judgment of experts and their quantification of the uncertainties about their input into a seismic hazard analysis using a simulation approach.

19627 (NUREG/CR—5250-Vol.2) **Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Results and discussion for the Batch 1 sites.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 324p. (UCID—21517-Vol.2). NTIS, PC A14/MF A01 - GPO - OSTI. Order Number TI89007726/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which

contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume (Volume 6). Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 2, presents the seismic hazard estimates for the 19 sites in "Batch 1".

19628 **(NUREG/CR—5250-Vol.3) Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Results and discussion for the Batch 2 sites.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 291p. (UCID—21517-Vol.3). NTIS, PC A13/MF A01 - GPO - OSTI. Order Number TI89007725/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume (Volume 6). Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 3, presents the seismic hazard estimates for the 17 sites in "Batch 2".

19629 **(NUREG/CR—5250-Vol.4) Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Results and discussion for the Batch 3 sites.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 282p. (UCID—21517-Vol.4). NTIS, PC A13/MF A01 - GPO - OSTI. Order Number TI89007724/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume. Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 4, presents the seismic hazard estimates for the 16 sites in "Batch 3".

19630 **(NUREG/CR—5250-Vol.5) Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Results and discussion for the Batch 4 sites.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 288p. (UCID—21517-Vol.5). NTIS, PC A13/MF A01 - GPO - OSTI. Order Number TI89007704/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume (Volume 6). Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 5, provides the seismic hazard estimates for the 17 sites in "Batch 4".

19631 **(NUREG/CR—5250-Vol.7) Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Questionnaires.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 606p. (UCID—21517-Vol.7). NTIS, PC A99/MF A01 - GPO - OSTI. Order Number TI89007705/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume (Volume 6). Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 7, provides the questionnaires used from the beginning of the study.

19632 **(NUREG/CR—5250-Vol.8) Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Supplementary seismic hazard results for sites with multiple soil conditions.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 209p. (UCID—21517-Vol.8). NTIS, PC A10/MF A01 - GPO - OSTI. Order Number TI89007703/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume (Volume 6). Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. This document, Volume 8, contains the hazard results for the twelve sites which were primarily rock sites.

19633 **(PNL-SA—16281) Building wake diffusion.** Ramsdell, J.V. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 11p. (CONF-890133—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007238/JAW.

From 6. joint conference on applications of air pollution meteorology; Anaheim, CA, USA (29 Jan 1989).

A recent review of building-wake diffusion models for the Nuclear Regulatory Commission (NRC) compares model predictions of centerline concentrations in building wakes with concentrations observed in experiments at seven nuclear reactors. In general, the model predictions are conservative in that they tend to predict concentrations that are greater than those actually observed. However, the models show little skill in accounting for variations in the observed concentrations. Analysis of experimental data indicates that the general form of the standard wake diffusion models is inconsistent with observed variation of concentrations in the wakes. The inconsistency is especially marked for ground-level releases. As an interim measure, multiple linear regression techniques have been used to develop a statistical building wake model alternative to the current models. This paper describes the statistical wake model and compares it with other models. 11 refs., 4 figs.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 19613, 19641, 20143

19634 **(CTA-IEAv-RI—03/86) Pre-design stage of the intermediate heat exchanger for experimental fast reactor.** Luz, M.; Borges, E.M.; Braz Filho, F.A.; Hirdes, V.R. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Sep 1986. 23p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705428/JAW.

This report presents the outlines of a thermal-hydraulic calculation procedure for the pre-design stage of the Intermediate Heat Exchanger for a 5 MW Experimental Fast Reactor (EFR), which can be used in other similar projects, at the same stage of evolution. Heat transfer and heat loss computations for the preliminary design of the heat exchanger are presented.

19635 **(EGG-M—88037) Reactor physics design for an epithermal neutron beam at the power burst reactor facility.** Wheeler, F.J.; Rushton, B.L.; Parsons, D.K.; Nigg, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-8805150—10). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005172/JAW.

From 4. international conference on neutron capture therapy; Bremen, F.R. Germany (31 May 1988).

An epithermal neutron beam facility has been designed for the Power Burst reactor Facility (PBF). The beam will have a broadband epithermal (1.0 eV - 10 keV) spectrum with extraordinary intensity and collimation with minimum fast neutron and gamma contamination. The PBF reactor is located at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho, USA. This facility has fulfilled its mission in the light-water reactor safety program and is currently on standby status. The PBF reactor core is situated in an open water-filled tank with a closed-loop coolant system. For BNCT, the core would operate at a steady-state thermal power of 20 MW. The core has a very high metal-to-water ratio which results in an intermediate-energy spectrum and is ideally suited for delivering an intense beam of epithermal neutrons. 7 refs., 3 figs.

19636 **(JAERI-M—88-199) Underwater plasma arc cutting of in-reactor tube of In-Pile Creep Test Facility.** Suzuki, Shinobu; Ichihashi, Yoshinori; Nakazaki, Chozaburo; Nagamatsuya, Takaaki; Nakata, Hirokatsu; Itami, Hiroharu. (Japan Atomic Energy Research Inst., Oarai, Ibaraki. Oarai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756916/JAW.

The in-reactor tube of the In-Pile Creep Facility had been irradiated periodically for over 6 years in the Japan Materials Testing Reactor (JMTR) up to the end of 1978 under an operating condition of high temperature and high pressure identical to that of the Prototype Advanced Thermal Reactor, FUGEN, to gain the basic data for estimating the amount of creep which would occur in the pressure tubes of FUGEN. Following the removal of the in-reactor tube out of the JMTR, the test sections in the tube which were to be subjected to post irradiation examination were cut out. Underwater plasma arc cutting was employed to prevent the spread of contamination to the work area, to confine the heat affected zone in the test pieces to a minimum and to simplify disposal of the unneeded portions of the pressure tube. Setup of the cutting machine, cutting operations, radiological conditions during cutting of the highly radioactive portion of the tube and disassembly of the cutting equipment are described. In addition a brief description of the underwater plasma arc cutting machine is presented. The hot-cutting operations were done remotely to control personal exposure. The containment envelope prevented the spread of contamination to the environment and radioactive particles deposited on the cutting machine were removed without any difficulties. External exposure received by cutting personnel was small. Internal radionuclide deposit examinations were conducted, determining no crew member inhaled radioactive substances. Contamination spreads to the work area were minimal and release of radionuclide was well controlled.

19637 **(KFKI—1988-49/E) Cold neutron source at the Budapest WWR-SM reactor.** Zsigmond, Gy.; Barth, P.; Cser, L.; Rosta, L.; Szalok, M. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Oct 1988. 35p. (In Hungarian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705574/JAW.

Upgrading and complete reconstruction of the KFKI WWR-SM reactor includes the installation of a cold neutron source in order to improve neutron scattering facilities for condensed matter research. The principles of cold neutron moderators are given, and the operation as well as the main elements of a small size cell liquid hydrogen cold source planned to be installed are presented describing also the installation and testing procedures. The most important hazard factors and safety problems are analyzed. (author) 24 refs.; 8 figs.; 1 tab.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 19416

19638 **Characterization of consistent NDA standards.** Rodenburg, W.W.; Novak, E.F.; Seiler, R.J. (Monsanto Research Corp., Mound Facility, Miamisburg, OH (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 713-717(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

By combining calorimetry and traditional analytical methods five sets of unique NDA standard were characterized for the Sa-

vannah River Plant (SRP) of E.I. duPont de Nemours, Inc. The calorimetry measurements made it possible to nondestructively verify the homogeneity of the plutonia stock and to assure that the analytical aliquouts were representative of the parent material. Two assay values were determined by calorimetric assay. When the isotopic composition was determined by mass spectroscopy and alpha pulse height analysis, the agreement between Pu content by calorimetry and controlled potential calorimetry was within 0.06% for all five isotopic compositions. When nondestructive, gamma-ray isotopic techniques were used to assay the 1500 gram standards the agreement was within 0.1% for all five materials.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 19388, 19574, 19591, 19599, 19614, 19624, 19626, 19627, 19628, 19629, 19630, 19631, 19632, 19807, 19808, 19993, 20296, 20298, 20315, 20567, 20738

19639 **(CONF-881014—20) Results of EPRI/ANL DCH investigations and model development.** Spencer, B.W.; Sienicki, J.J.; Sehgal, B.R.; Merilo, M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007372/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The results of a series of five experiments are described addressing the severity and mitigation of direct containment heating. The tests were performed in a 1:30 linear scale mockup of the Zion PWR containment system using a reactor-material corium melt consisting of 60% UO_2, 16% ZrO_2, 24% SSt at nominally 2800C initial temperature. A "worst-case" type test involving unimpeded corium dispersal through an air atmosphere in a closed vessel produced an atmosphere heatup of 323K, equivalent to a DCH efficiency of 62%. With the addition of structural features which impeded the corium dispersal, representative of dispersal pathway features at Zion, the DCH efficiency was reduced to 1--5%. (This important result is scale dependent and requires larger scale tests such as the SURTSEY program at SNL plus mechanistic modeling for application to the reactor system.) With the addition of water in the cavity region, there was no measurable heatup of the atmosphere. This was attributable to the vigorous codispersal of water with corium which prevented the temperature of the atmosphere from significantly exceeding T/sub sat/. In this case the DCH load was replaced by the more benign "steam spike" from corium quench. Significant oxidation of the corium constituents occurred in the tests, adding chemical energy to the system and producing hydrogen. Overall, the results suggest that with consideration of realistic, plant specific, mitigating features, DCH may be no worse and possibly far less severe than the previously examined steam spike. Implications for accident management are addressed. 17 refs., 7 figs., 4 tabs.

19640 **(CONF-890360—2) Modular high-temperature gas-cooled reactor core heatup accident simulations.** Ball, S.J.; Conklin, J.C. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007205/JAW.

From Eastern multiconference; Tampa, FL, USA (28 Mar 1989).

The design features of the modular high-temperature gas-cooled reactor (HTGR) have the potential to make it essentially invulnerable to damage from postulated core heatup accidents. Simulations of long-term loss-of-forced-convection (LOFC) accidents, both with and without depressurization of the primary coolant and with only passive cooling available to remove afterheat, have shown that maximum core temperatures stay below the point at which fuel failures and fission product releases are expected. Sensitivity studies also have been done to determine the effects of errors in the predictions due both to uncertainties in the modeling and to the assumptions about operational parameters. 4 refs., 5 figs.

19641 **(EGG-M—39387) Observations on the chemical processes and products from the four PBF [Power Burst Facility] severe fuel damage tests.** Osetek, D.J.; Petti, D.A.; Hagrman, D.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 31p. (CONF-871236—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005167/JAW.

From Workshop on chemical processes and producers in severe reactor accidents; Captiva Island, FL, USA (9 Dec 1987).

Four in-pile severe fuel damage tests have been conducted in the Power Burst Facility as part of the United States Nuclear Regulatory Commission's (USNRC) Severe Accident and Source Term Research Programs. The tests included 1-m-long bundles of PWR fuel pins and simulated the thermal-hydraulic and fuel damage conditions of a severe core damage accident. Tests were run with both low and high burnup fuel, low and high coolant flow and with slow and rapid cooldown. One test included Ag-In-Cd control rods. The various types of fuel damage that occurred in the four tests are presented and the measured hydrogen generation, fission product release, and aerosol behavior are described. The chemical behavior observed in the tests and the chemical analyses used to evaluate the fission product and aerosol data are described. Some of the computer models affected by the test results are discussed. The principal benefits of the test program have been to improve the USNRC's severe accident analysis capability. 13 refs., 19 figs., 4 tabs.

19642 **(ICP-CEH—021(S)) Working group on health hazards from radiocaesium and other long-lived radionuclides following the Chernobyl accident. Summary report.** (World Health Organization, Copenhagen (Denmark). Regional Office for Europe). Jul 1987. 2p. (CONF-8706379—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88706027/JAW.

From Working group on health hazards from radiocaesium and other long-lived radionuclides following the Chernobyl accident; Guenzburg, F.R. Germany (9 Jun 1987).

Also published in French, German and Russian.

The meeting of this Working Group was the latest in a series of meetings convened by the WHO Regional Office for Europe. On the basis of the available data, the average individual dose in Europe of radiocaesium through all pathways was estimated to have been about 0.3 mSv in the first year and to be about 0.06 mSv for the whole 50-year period after the Chernobyl accident. These are weighted averages for all of Europe, excluding the USSR.

19643 (INIS-BR—1411, pp 197-227) **Emergency planning and preparedness for nuclear facilities in the Federal Republic of Germany.** Koelzer, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Because of their inventories of radioactive materials nuclear facilities represent a hazard potential which, though comparable with that posed by other large technical facilities, demands particular protective measures to be taken. As a consequence of the extreme safety provisions, made, accidents with major impacts on the environment of nuclear facilities are excluded to the best human knowledge. However, as there are distinct limits to human planning and recognition, a residual risk remains despite all these precautions. In order to reduce that risk, recommendations for emergency protection in the environment of nuclear facilities have been drafted. To the extent in which measures are required outside the specific emergency protection plans apply which contain non-object related planning preparations. The recommendation also omits potential repercussions of nuclear accidents which might require measures in the sector of preventive health protection under the Radiation Protection Provisions act or the government measures to be taken. The recommendation is applied to German nuclear installations and those foreign installations whose proximity to the border requires planning measures to be taken on German territory in the sense of this recommendation.

19644 (INIS-mf—11896, pp 2.1-2.17) **Representation of crack and defect-structures by evaluation of eddy-current signals.** Thomas, H.M.; Wittig, G. (Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The pulse eddy-current testing method was used to study the near-surface area of a reactor pressure vessel nozzle. HPR nozzles damaged by thermal shock revealed that crack depths could not be determined in crack fields due to the lateral restriction of resolution of the oil systems used. These complicated signal courses cannot be evaluated unless we gain an understanding of probe behaviour in conjunction with the local distribution of the individual cracks involved. Hence, a high-resolution coil system was developed. A computer-aided analysis procedure was used to produce a defect image of the tested surfaces.

19645 (INIS-mf—11897, pp 25.1-25.63) **Some conclusions with regard to the safety assessment of cracked components drawn from the research program 'integrity of components (FKS II)' at the present state.** Kussmaul, K.; Foehl, J.; Roos, E. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

A special determination method allowed to confirm the transferability of fracture mechanics parameters for crack initiation. A correlation was found between notch impact energy and crack initiation value for the higher shelf of toughness. Carrying and deformation behaviour of components can be determined when stress condition and multi-axis degree are known. The onset of stable and cyclical crack expansion can be verfied by sound emission techniques under corrosive conditions, too. The operational influence of corrosion and radiation can be quantified for specific conditions and states.

19646 (INIS-mf—11897, pp 27.1-27.21) **Probability of leakage in piping systems of pressurized water reactors on the basis of fracture mechanics and operating experience.** Beliczey, S.; Schulz, H. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Probabilities of leakages in piping systems as used in risk studies up to now do not represent present knowledge. The goal of this investigation is to formulate a new set of probabilities of leakages in piping systems of German PWRs for the whole range of pipes of interest using the operating experience, the principles of the basis safety approach and fracture mechanics studies.

19647 **(JAERI-M—88-213) Evaluation report on SCTF Core-III test S3-06. Effect of radial power distribution on thermal-hydraulic characteristics of PWR with combined injection type ECCS.** Iwamura, Takamichi; Iguchi, Tadashi; Akimoto, Hajime; Okubo, Tsutomu; Ohnuki, Akira; Adachi, Hiromichi; Murao, Yoshio; Minato, Akihiko; Sakaki, Isao. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 128p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756920/JAW.

In order to investigate the effect of radial power distribution on the thermal-hydraulic characteristics during the reflood phase of a PWR-LOCA with a combined injection type ECCS, a core cooling separate effect test S3-06 and a combined injection test S3-16-Phase 2 were performed using the Slab Core Test Facility (SCTF) Core-III. The radial power distributions in these two tests simulated a reference distribution for a PWR with a combined injection type ECCS and a steep distribution for a PWR with a cold leg injection type ECCS, respectively. Under the radial power distribution of a PWR with a combined injection type ECCS, the radial power distribution had little effect on the thermal-hydraulic behavior in the two-phase up-flow region due to the approximately flat power distribution in this region (power ratio = 1.04 {similar←to} 1.08). The overall fluid behavior in the pressure vessel was also little affected by the radial power distribution. On the other hand, under the steep radial power distribution (peak power ratio = 1.36), the degree of heat transfer enhancement in high power bundles in the two-phase up-flow region was dominated by the bundlewise radial power ratio as in the case of a PWR with a cold leg injection type ECCS.

19648 **(JAERI-M—88-215) Post-test analysis with RELAP5/MOD2 of ROSA-IV/LSTF natural circulation test ST-NC-02.** Chauliac, C.; Kukita, Yutaka; Kawaji, Masahiro; Nakamura, Hideo; Tasaka, Kanji. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756922/JAW.

Results of post-test analysis for the ROSA-IV/LSTF natural circulation experiment ST-NC-02 are presented. The experiment consisted of many steady-state stages registered for different primary inventories. The calculation was done with RELAP5/MOD2 CYCLE 36.00. Discrepancies between the calculation and the experiment are observed: the core flow rate is overestimated at inventories between 80 % and 95 %; the inventory at which dryout occurs in the core is also much overestimated. The causes of these discrepancies are studies through sensitivity calculations and the following key parameters are pointed out: the interfacial friction and the form loss coefficients in the vessel riser, the SG U-tube multidimensional behaviour, the interfacial friction in the SG inlet plenum and in the pipe located underneath.

19649 **(NUREG—1137-Suppl.8) Safety evaluation report related to the operation of Vogtle Electric Generating Plant, Units 1 and 2 (Docket Nos. 50-424 and 50-425): Supplement 8.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1989. 108p. NTIS, PC A06/MF A01 - GPO - OSTI. Order Number TI89007970/JAW.

In June 1985, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-1137) regarding the application of Georgia Power Corporation, and the City of Dalton, Georgia, for licenses to operate the Vogtle Electric Generating Plant, Units 1 and 2 (Docket Nos. 50-424 and 50-425). Supplement 1 to NUREG-1137 was issued by the Staff in October 1985, Supplement 2 was issued in May 1986, Supplement 3 was issued in August 1986, Supplement 4 was issued in December 1986, Supplement 5 was issued in January 1987, Supplement 6 was issued in March 1987, and Supplement 7 was issued in January 1988. The facility is located in Burke County, Georgia, approximately 26 miles south-southeast of Augusta, Georgia, and on the Savannah River. This eighth supplement to NUREG-1137 provides recent information regarding resolution of some of the open and confirmatory items that remained unresolved following issuance of Supplement 7. 5 figs., 3 tabs.

19650 **(NUREG/CR—5250-Vol.6) Seismic hazard characterization of 69 nuclear plant sites east of the Rocky Mountains: Regional comparison between sites, site effects, general discussion, and conclusions.** Bernreuter, D.L.; Savy, J.B.; Mensing, R.W.; Chen, J.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 134p. (UCID—21517-Vol.6). NTIS, PC A07/MF A01 - GPO - OSTI. Order Number TI89007673/JAW.

The EUS Seismic Hazard Characterization Project (SHC) is the outgrowth of an earlier study performed as part of the US Nuclear Regulatory Commission's (NRC) Systematic Evaluation Program (SEP). The objectives of the SHC were: (1) to develop a seismic hazard characterization methodology for the region east of the

Rocky Mountains (EUS), and (2) the application of the methodology to 69 site locations, some of them with several local soil conditions. The method developed uses expert opinions to obtain the input to the analyses. An important aspect of the elicitation of the expert opinion process was the holding of two feedback meetings with all the experts in order to finalize the methodology and the input data bases. The hazard estimates are reported in terms of peak ground acceleration (PGA) and 5% damping velocity response spectra (PSV). A total of eight volumes make up this report which contains a thorough description of the methodology, the expert opinion's elicitation process, the input data base as well as a discussion, comparison and summary volume (Volume VI). Consistent with previous analyses, this study finds that there are large uncertainties associated with the estimates of seismic hazard in the EUS, and it identifies the ground motion modeling as the prime contributor to those uncertainties. 5 refs., 66 figs.

19651 **(RISO-M—2726) Health Physics Department. Annual progress report 1 January - 31 December 1987.** (Risoe National Lab., Roskilde (Denmark)). Aug 1988. 48p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE89780067/JAW.

The report describes the work of the Health Physics Department at Risoe during 1987. The activities cover dosimetry, instrumentation, radioecology, risk by nuclear activities and nuclear emergency preparedness. Lists of staff and publications are included. The main emphasis in the report has been placed on scientific and contractual work. However, service functions do constitute a substantial work load for the department.

19652 **Assessing potential consequences of radiological sabotage.** Deal, L.J.; Cherry, R.C. (Lamb Associates, Inc., Rockville, MD (US); Meridian Corp., Alexandria, VA (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 73-78(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

In the aftermath of Chernobyl, major initiatives were undertaken in the area of nuclear safety. However, such initiatives do no take into full consideration the potential consequences resulting from acts of radiological sabotage. Two approaches for assessing the potential consequences of radiological releases due to sabotage are discussed. First, where qualitative assessments can be made by analysts knowledgeable of the facility and its operations, criteria for ranking the facility are described. Second, in cases where more specific information is required, quantitative criteria are suggested.

19653 **Applications of transient response characterization and enhancement to thermal instrumentation.** Bainbridge, B.L.; Keltner, N.R. (Sandia National Labs., Albuquerque, NM (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

Thermal sensors have transient response characteristics that may be examined using external or internal stimulation tests. The test data can be coupled with simple sensor models, consisting of two or three term approximations to the solution of partial differential equations, or more complex ones based on techniques such as the unsteady surface element method. The test data provides information for determining the unknown parameters in the approximating equations. The combination of model and test data is used to produce an estimate of the transfer function represented by the sensor. The estimate can then be applied to experimental data obtained from the sensor to improve the quality of the information. The technique of combining step response data and simple models has been applied in a variety of cases. Some of the applications include the effects of adhesive on the response of surface mounted resistance temperature detectors, the use of an on-line circuit in a flight vehicle to monitor the bonding condition of mounted sensors, a project aimed at improving the resolution of temperature data obtained from the containment building of the TMI-2 nuclear power station and for compensating the output from an intrinsic thermocouple. Response compensation requires a model that represents the inverse of the transfer function of the sensor. The previously mentioned experiments have shown that simple models can provide adequate representations of sensor for the purposes of compensation. A thermal sensor acts as a low pass filter which attenuates information necessary for determining the parameters of response models. In combinations with system noise, the filtering effect limits the accuracy of any compensation system such that simple models will provide results commensurate with more detailed ones.

19654 **A preliminary study of oxidation-resistant coatings on refractory-metal thermocouple sheaths.** Wilkins, S.C. (EG and G Idaho, Inc., Idaho Falls, ID (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

The need to make reliable temperature measurements up to 2200°C or higher in steam environments during in-pile nuclear fuel damage tests led to a search for oxidation-resistant coatings for the refractory-metal sheaths used to enclose and protect thermocouples used for such measurements. Iridium, thoria, and thoria-over-iridium coatings were separately sputter-deposited on molybdenum-rhenium alloy protection tubes for evaluation. The coated samples were individually heated in flowing steam in an induction furnace. An extension tube welded to each sample was connected to a vacuum pump and gauge; failure of the sample was detected by noting the degradation of the vacuum maintained in the sample. Relatively heavy coatings of iridium provided a modest degree of oxidation protection at the temperatures of interest. Thoria coatings provided no significant protection at those temperatures, compared to uncoated control samples.

19655 **(ORNL/tr—89/11) Emergency accumulator.** (Oak Ridge National Lab., TN (USA)). 4 Nov 1984. Contract AC05-84OR21400. Translated from German Democratic Republic Patent No. 160 841, 4 Feb 1981. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008818/JAW.

The invention RU 4100-80, entitled "Emergency Steam Accumulator," concerns the basic equipment of an important safety subsystem, with which two-loop nuclear power plants having pressurized water reactors or water-water reactors are provided (at present in all cases). The invention increases the effectiveness of this equipment and the corresponding subsystem; through it, the material consumption can be considerably reduced and the temperature of the borated water before feed into the primary emergency loop can be approximated to a value that is optimum from the standpoint of unstable operating conditions and reactor life, whereby a constant degree of passivity and operating safety in the safety devices to be designed in accordance with the innovation and also in the existing storage tanks is retained, for all practical purposes. The principal design and functional characteristics of the safety equipment are as follows: a relatively high level of borated water in the emergency accumulator, higher temperature conditions in its upper section in the standby state, isobaric borated water displacement, and suction of the secondary heat transfer agent into the outlet nozzle on the longitudinal side during operation of the emergency steam accumulator. 1 fig.

25 ENERGY STORAGE

19656 **(STU—86-4122) Hydraulic double tube pressure accumulator for energy storage.** Nilsson, L. (Stroemsholmens Mekaniska Verkstad AB, Tranaas (SE)). (Swedish National Board for Technical Development, Stockholm). 21 Dec 1987. 28p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757088/JAW.

The aim of the project was to study the possibility, by using today's technique, of storing energy produced by deceleration of vehicles, primarily buses in an efficient and commercially attractive way. The work was centered on energy storage where, besides max amount of energy, also min weight is the main design criterion. The solution was to apply a composite material in both inner ant outer tube and a high strength pressure vessel steel in bottoms. (O.S.).

2502 Compressed Gas

REFER ALSO TO CITATION(S) 19545

2504 Capacitor Banks

REFER ALSO TO CITATION(S) 20039

2506 Thermal

REFER ALSO TO CITATION(S) 19716, 19746, 19773

19657 **(VTT-TIED—844) Heat storage in bedrock by borehole pipes.** Ritola, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Mar 1988. 136p. (In Finnish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757108/JAW.

The energy sources on which the feasibility of seasonal storage is based include solar heat, communal and industrial waste heat and heat from electricity production in back-pressure power plants, for which there is not always demand in the summer. These energy sources would make it possible to substitute for the expensive oil-fired peak energy used during the winter, if sufficiently cheap storage methods were available for large amounts of heat. This study investigated the potential use of heat stores built into the bedrock using boreholes for heat systems of different size classes. The study started with a survey of the literature. This was used to asses the storage requirements of various heat systems and to plan store models for single-building heating systems and for localized and remote district heating systems. Three-dimensional computerized heat technology simulation calculations were made for the use of the store models. In addition, the construction, investment and running costs for the stores were calculated and used to calculate the specific investment costs and heat storage costs for the stores. With storage capacities of 874 000 m/sup 3/ and 103 000 m/sup 3/ the achievable heat store costs of storage calculated per energy unit are 0.07 and 0.10 FIM/kWh, respectively; with a 8 000 m/sup 3/ capacity the cost would be 0.19 FIM/KWh, calculated at a real interest rate of 5%. The results indicate that large bore-hole stores could produce heat that could compete at least with peak energy produced with oil for localized and remote district heating, if the storeable heat, including cost of collection, does not cost more that 0.05 FIM/kWh. The seasonal storage cost of heat from single-building heat stores is so high that seasonally stored heat is not competitive in terms of price with other single-building heating methdos.

2509 Batteries

REFER ALSO TO CITATION(S) 19807, 19808

19658 **(ANL/PPRNT—89-135) A method for preventing cathodic deposition of molybdenum subchloride in LiCl-KCl molten salt.** Koyama, Koichiro; Shimotake, Hiroshi. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008394/JAW.

Effects of ions of Group IA, IIA, IIIB, and VIIB elements on the cathodic deposition of a molybdenum were investigated in a KCl-LiCl (eutectic)-$MoCl_3$ molten salt at 773 K (500{degree}C). The results can be summarized as follows: The addition of potassium, rubidium, cesium, and barium cations and fluorine anions to the KCl-LiCl (eutectic)-$MoCl_3$ molten salt is effective in depressing the cathodic deposition of the molybdenum subchloride, which hinders the smooth, flat electrodeposition of molybdenum. The addition of lithium, sodium, magnesium, calcium, strontium, and aluminum cations and bromine and iodine anions promotes the undesirable cathodic deposition of the molybdenum subchloride.

19659 **(CONF-881061—14) Li-alloy/transition-metal sulfide cells designed for overcharge tolerance.** Redey, L. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007504/JAW.

From Electrochemical Society fall meeting; Chicago, IL, USA (9 Oct 1988).

To explore the capability of the controlled self-discharge process for chemical overcharge protection, several LiAlSi/LiF-LiCl-LiBr- MgO/FeS and LiAlSi/LiCl-LiBr-KBr-MgO/FeS cells were built and tested. The electrode material formulas do not indicate real compounds; they merely represent electrode compositions that are normalized to one mole of the negative matrix material (Al and Si), thereby fixing the atom ratios of Al:Si:Fe:S in the cell. Overcharge is a serious problem in batteries. Maintaining the charge voltage of each cell at or below the voltage limit and simultaneously reaching equal capacity in each series-connected cell of a lithium-alloy/metal sulfide battery over many cycles are difficult tasks. For lithium-alloy/monosulfide cells, a possible method of chemical overcharge protection is use of a controlled self-discharge process, as described in this article. 11 refs., 3 figs.

19660 **(CRIE-T—87045) Research and development of zinc-iodine cell (Part. 2). Improvement of cycle life and scale up.** Iwahori, Toru; Ishikawa, Rikio; Kumai, Kazuma; Maruyama, Kensaku. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). May 1988. 46p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756457/JAW.

Causal analysis of zinc-iodine cell life, countermeasures and effect of cycle life improvement, and scale up and stacking of unit cells were studied. When the charge and discharge were made with 10 hour rate current(current= cell capacity/10) assuming the utilization of cell as the load conditioner to adjust the load as a new application, the 70% of all cells indicated life equal to or less than 50 cycles. The main cause was the dendrite deposition on the cathode, resulting short circuit or dendrite falling from cathode plate. The measures to inhibit dendrite formation were differently studied. The most effective one was lead coolector on the cathode to enlarge the electrode area, resulting two or three times life up to maximum 400-600 cycles but it was difficult to achieve the aim. Scaling up of electrode area and stacking tend to shorten the life but result better efficiency, capacity and discharge rate. (41 figs, 16 tabs, 3 refs)

19661 **(CRIE-T—87051) Research and development of lithium/polyaniline battery.** Takei, Katsuhito; Ishihara, Kaoru. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1988. 42p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756458/JAW.

This paper presents a compact lightweight secondary battery for load conditioner. A 0.1 Wh-battery using conducting high-polymer, polyaniline, as the positive electrode, Li as the negative electrode and a 1 mol propylene carbonate solution of lithium perchlorate as the electrolyte was fabricated on an experimental basis. Polyaniline with fibril 0.2 - 10 μm in diameter was synthesized by the electrolytic polymerization changing the quantity of current. The charge/discharge potential is 1 V higher and the energy efficiency is 20% higher than those of lead storage battery. Using polyaniline with fibril 1.0 μm or more in diameter, the discharge capacity is decreased. Approximately 50% of anion doped in polyaniline during the polymerization could be removed by washing with distilled water. The region of stably operating potential ranges from 4.0 - 2.5 V and anion doping is 55%. The energy density of battery is 75 - 90 Wh/kg or 90 - 105 Wh/l which are two-and 1.5-times those of lead storage battery, respectively. The latter figure is lower than the target value. (21 Figs, 6 tabs, 3 photos, 15 refs)

19662 **Corrosion in batteries and fuel-cell power sources.** Cieslak, W.R. (Exploratory Batteries Div., Sandia National Labs. (US)). pp v of Metals handbook ninth edition. Volume 13. Corrosion. Houston, TX; Gulf Publishing Company (1987).

Batteries and fuel cells, as electrochemical power sources, provide energy through controlled redox reactions. Because these devices contain electrochemically active components, they place metals in contact with environments in which the metals may corrode. The shelf lives of batteries, particularly those that operate at ambient temperatures depend on very slow rates of corrosion of the electrode materials at open circuit. The means of reducing this cor-

rosion must also be evaluated for its influence on performance. A second major corrosion consideration in electrochemical power sources involves the hardware. Again, shelf lives and service lives depend on very good corrosion resistance of the containment materials and inactive components, such as separators. In those systems in which electrolyte purity is important, even small amounts of corrosion that have not lessened structural integrity can degrade performance. There is a wide variety of batteries and fuel cells, and new systems are constantly under development. Therefore, to illustrate the types of corrosion phenomena that occur, this article will discuss the following systems: lead-acid batteries, alkaline batteries (in terms of the sintered nickel electrode only), lithium ambient-temperature batteries, aluminum/air batteries, sodium/sulfur batteries, phosphoric acid (H/sub 3/PO/sub 4/) fuel cells, and molten carbonate fuel cells.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 21452

19663 **(RIE—1987) Canadian mining equipment and services.** (Department of Regional Industrial Expansion, Ottawa, Ontario (Canada)). 1987. 104p. (In English and French). (MICROLOG—88-02853). Dept. of Regional Industrial Expansion, Public Information Branch, 235 Queen St., Ottawa, Ont., Canada K1A 0H5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A directory is provided of Canadian providers of materials and services to the mining industry. Manufacturers, suppliers, contractors, and consultants are listed under subject headings including airborne geophysics instruments, drilling tools, geochemistry equipment, trituration and separation, material-handling equipment, general plant equipment, equipment for open pit mining, and equipment for underground mining.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 19517, 19665, 19770, 19776, 20499

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 19254, 19270, 19271, 19272, 19273, 19274, 19275, 19461, 19693, 19805, 19811

19664 **(DOE/CE/65600—T10) Financing energy conservation in municipal and non-profit institutional buildings: Final report.** (Energy Task Force Management Corp., Houston, TX (USA)). 10 Aug 1988. Contract FC01-84CE65600. 260p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007719/JAW.

This final report records the history of the project and provides detailed accounts of the performance contracting process for each of the four participating local governments. We regret that at the three year point at which the project concluded none of the participating sites had fully installed retrofits that we could evaluate for project performance. Such longer term performance information will be essential to any real conclusions regarding the relative successes in municipal performance contracting for building energy retrofits. 3 tabs.

19665 **(ESC—45) Impacts of lower fuel prices on the results of the NEV-scenarios.** Boonekamp, P.G.; Verhagen, L. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Sep 1988. 64p. (In Dutch). Energie Studie Centrum ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Last year a National Energy Outlook (NEV 1987) was completed which contained a set of three energy scenarios describing a range of plausible developments of the Dutch energy sector up to the year 2010. The effects of 30 to 40% lower fuel prices on the results of the National Energy Outlook are analysed. The results show that the overall costs of energy supply decrease by 16 to 24%. The potential for fuel substitution is limited to public power generation and large scale industrial steam production (cogeneration). In public power generation the competition between coal and natural gas remains in favour of coal. Nuclear energy, however, is substituted by coal in two scenarios, because of cheaper electricity production with coal. In industrial steam generation gas-fired cogeneration replaces coal-fired cogeneration and coal-fired steam boilers. The total cogeneration capacity remains the same or increases up to 36% depending on the scenario and policy case. The total effect of these changes is a modest transition from coal to gas and a slightly decreasing total SO/sub 2/-emission. The total NO/sub x/-emission remains more or less the same. In the nuclear cases of two scenarios, however, coal use and emissions increase. If final demand for energy is corrected for lower energy savings due to lower prices, total energy use increases by about 3%. In this case SO/sub 2/- and NO/sub x/-emissions are higher than in the National Energy Outlook. 8 figs., 8 refs., 20 tabs.

19666 **(IFP—36-428) Theory and implementation of the Translog function in energy modelization.** Poirier, F. (Paris-2 Univ., 75 (France); Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France)). Jun 1987. 331p. (In French). NTIS (US Sales Only), PC A15. Order Number DE88756976/JAW.

The Translog (Transcendental logarithmic) function is introduced and its applications to empirical and production functions evaluations. The econometric implementation of Translog is realized and software programs have been used to solve constrained simultaneous evaluation equations. Two applications of Translog modelization are presented which concern substitutions between the four main energy sources in industry: oil products, solid fuels, electricity and gas. One in France, the second in the U.S.A.

19667 **(NWT—1987) Government of the Northwest Territories annual report, 1987.** Harvey, R.M. (ed.). (Northwest Territories, Yellowknife (Canada)). 1988. 86p. (MICROLOG—88-04208). Northwest Territories. Dept. of Renewable Resources, P.O. Box 1320, Yellowknife, N.W.T., Canada X1A 2L9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Government of the Northwest Territories issues a combined annual report for all departments and agencies. Information contained in this report covers native rights, energy policy, women's issues, education, public works, cultural affairs, government services and finance, health and social services, economic development and tourism, justice, renewable resources, housing, highways, public utilities and workers' compensation. In addition, there is a report from the courts, the Legislative Assembly and the Office of the Commissioner, and a report from each of the regional governments describing the accomplishments for the year 1987. 55 Figs., 2 tabs.

19668 **(SEG—8811) Analyzing Canadian prices and markets.** Harris, P. (Southam Energy Group, Calgary, Alberta (Canada)). 1988. 527p. (CONF-8811178—; CE—02362). Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN.

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

A conference was held to analyze Canadian prices and markets for natural gas, petroleum products, crude oil, electricity, natural gas liquids, coal, and uranium. Presentations were made on topics including natural gas sales and exports; energy futures trading; marketing and transporting natural gas liquids; refined fuels; inter-fuel competition in central Canada among electricity, gas, and refined products; toal prices, and domestic and export markets; uranium marketing; Canadian megaprojects; crude oil economics; and world oil price trends. Separate abstracts have been prepared for fifteen papers from this conference.

19669 **(SPK-PM—1988-3) Competitive strength of different energy carriers.** (Statens Pris- och Kartellnaemnd, Stockholm (Sweden)). Apr 1988. 103p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757073/JAW.

The Price and Cartel Office has studied the market and price developments for the most important energy forms, i.a. the taxation effects on the market competition. The philosophy of the energy taxation is to lead to a reduced oil dependence, reduced environmental harm and a more efficient energy use. As a consequence, the taxation varies steeply between different energy sources: For gasoline 165 percent, coal 100 percent, domestic fuels (wood and peat) 0 percent. For electricity, the mean taxation level lies between 20 and 30 percent. However, for many energy uses the possibilities to change the market shares for different energy sources are quite small, at least on short or medium-long terms. The effects of introducing VAT on energy are also studied. The negative effects seem to be dominating: e.g. the environmental and energy political steering is lost and the state income from energy use will vary considerably due to the market price variations. (L.E.).

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 19337, 20499, 20500, 20501, 20546, 20547, 20593, 20626, 20627

19670 **(EFN—29) Energy research and the environment. An evaluation of the treatment of environmental questions in the governmental energy research.** Andersson, O.; Josefsson, T. (Energiforskningsnaemnden, Stockholm (Sweden)). Jul 1988. 60p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757041/JAW.

Efn has evaluated Government work in R and D projects in the fields of energy and the environment. The evaluation has been carried out from a user perspective, with particular emphasis on how the results of research and development are applied. The investigation has centered on two main aspects: the realisation and applicability of the results of research and development, and the definition of the problems which the research will try to resolve. Instead of carrying out some form of post-implementation audit, Efn has performed two specific case studies and arranged a series of seminars. The case studies have involved analysis of the transfer of R and D results, and application of their effects. Efn has drawn conclusions based on the work, and posed a number of important questions. It is our opinion that several of the conclusions are of general validity, i.e. they can be applied to many areas over and above those investigated in the project. The results are valuable also for energy planners working at regional and community level. However, the conclusions and suggestions relate primarily to the Government energy research programme. (authors).

2904 Natural Resources

REFER ALSO TO CITATION(S) 19667, 20628, 20629

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 19207, 19268, 19295, 19442, 19680, 19684, 19740, 19744, 19792, 19793, 19794, 19809, 19865, 20113, 20528

19671 **(ORNL—6524) Instrumentation and Controls Division progress report for the period July 1, 1986 to June 30, 1988.** Klobe, L.E. (ed.). (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 303p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007857/JAW.

The Instrumentation and Controls (I&C) Division of Oak Ridge National Laboratory (ORNL) performs basic and applied instrumentation and controls research, development and design engineering, specialized instrument design and fabrication, and maintenance services for instruments, electronics, and computers. The I&C Division is one of the largest R&D organizations of its type among government laboratories, and it exists as the result of an organizational strategy to integrate ORNL's instrumentation and controls-related disciplines into one dedicated functional organization to increase the Laboratory's expertise and capabilities in these rapidly expanding, innovative areas of technology. The Division participates in the programs and projects of ORNL by applying its expertise and capabilities in concert with other divisions to perform basic research and mission-oriented technology development. Many of the Division's R&D tasks that are a part of a larger ORNL program are of sufficient scope that the I&C effort constitutes a separate program element with direct funding and management responsibility within the Division. The activities of I&C include performance of an R&D task in I&C facilities, the participation of from one of many I&C engineers and scientists in a multidisciplinary team working in a specific research area or development project, design and fabrication of a special instrument or instrumentation system, or a few hours of maintenance service. In its support and maintenance work, the role of the I&C Division is to provide a level of expertise appropriate to complete a job successfully at minimum overall cost and time schedule---a role which involves I&C in almost all ORNL activities.

19672 **(PNL-SA—16397) PNL-BMI patenting and licensing highlights since Bayh-Dole.** Eschbach, E.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 18p. (CONF-8811160—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006942/JAW.

From Federal laboratory consortium for technology transfer fall meeting; Mystic, CT, USA (15 Nov 1988).

This report highlights the patenting and licensing experiences at the Pacific Northwest Laboratories. Procedural devices that are being considered and concerns of the program management are also included.

19673 **(STEV—1988-3) Energy research 1987-1990.** (Statens Energiverk, Stockholm (Sweden)). Oct 1987. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757074/JAW.

The report describes the estimated funds and efforts going into the National Energy Administration's research area during the period 1987-1990. The activities have been broken down into fourteen technological areas as follows: * Wood fuels, MSEK 40. * Peat fuels, MSEK 40. * Energy cultivation, MSEK 50. * Coal, MSEK 10. * Alternative fuels, MSEK 15. * Combustion technology, MSEK 90. * Gasification technology, MSEK 35. * District-heating technology, MSEK 25. * Heat storage, solar, MSEK 10. * Geothermal energy, MSEK 5. * Heat-pump technology, MSEK 20. * Thermal power technology, MSEK 25. * Wind-power technology, MSEK 45. * Long-term electricity production technology, MSEK 15. * In total MSEK 425. Additional to this are natural-gas technology and municipal energy planning in which fields the Administration will report on planned operations in due course.

19674 **(UCRL—52000-88-11) Energy and Technology Review, November 1988.** Poggio, A.J.; Crawford, R.; Gleason, K.; Hendry, D.P.; Sanford, N.M.; Taft, S.O. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 33p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007941/JAW.

This review by Lawrence Livermore National Laboratory contains papers related to: cratering phenomenology revealed through discrete-element modeling; high-intensity short-pulse lasers; localized transmission of wave energy; and evidence of localized wave transmission.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 19391, 19407, 19411, 19864, 20738, 21558

19675 **(LBL-PUB—651) Introduction to the journal of Glenn T. Seaborg, Chairman of the US Atomic Energy Commission, 1961--1971.** Seaborg, G.T. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 88p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006621/JAW.

This serves as an introduction to the 25-volume detailed daily diary kept by Glenn T. Seaborg during the time he served as Chairman of the US Atomic Energy Commission. It is a brief synopsis of some of the major issues and accomplishments of that

period, 1961-1971, of US nuclear history. It is expected that the diary itself will be printed as a Lawrence Berkeley Laboratory report during the next year.

19676 **(NUREG—1350-Vol.1) Nuclear Regulatory Commission 1989 Information Digest.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Budget and Analysis). Mar 1989. 84p. NTIS, PC A05/MF A01 - GPO - OSTI. Order Number TI89008224/JAW.

The Nuclear Regulatory Commission 1989 Information Digest provides summary information regarding the US Nuclear Regulatory Commission, its regulatory responsibilities, and areas licensed by the Commission. This is the first of an annual publication for the general use of the NRC staff and is available to the public. The Digest is divided into two parts: the first presents an overview of the US Nuclear Regulatory Commission and the second provides data on NRC commercial nuclear reactor licensees and commercial nuclear power reactors worldwide.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 19567

2910 Conservation

REFER ALSO TO CITATION(S) 19733, 19770, 19771, 19772, 19773, 19833

19677 **(BOUWCENTRUM—11685) Energy demand in the built environment. Study A, phase 2.** De Graaf, W.J.; Weerdenburg, M.J. (Bouwcentrum, Rotterdam (Netherlands)). Apr 1987. 67p. (In Dutch). Bouwcentrum BV, P.O. Box 299, 3000 AG Rotterdam, Netherlands.

Research is carried out to the extent in which renewable energy sources in the Netherlands can meet the energy demand for the year 2050. Results of phase 2 of the section study on the energy demand in family households are presented. Possible developments concerning quantity, structure and characteristics of the dwellings supply are mentioned. Conceivable contributions of energy conservation options to decrease the energy demand in family households have been listed and analysed. Energy conservation options are considered for natural gas consumption and electric power consumption. Calculations have been made for four variants in which economic growth and thermal insulation policy are the variables. 10 refs., 55 tabs., 9 apps.

19678 **(EMR—EP77-7) Energy conservation in Canada: programs and perspectives.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1977. 61p. (CE—02381). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report centers around programs and opportunities for energy conservation in Canada in the major end-use sectors: buildings, transportation and industry. Realistically attainable savings have been estimated for conservation measures which are believed to be technically feasible, economically justified and considered socially acceptable. A number of other conservation measures or technologies are discussed but not quantified, since further research is needed before quantification is possible. One important example of this is the cogeneration of heat and electricity. The estimated savings from the implementation of a number of conservation measures are used to develop a single conservation scenario, which is based on a high price/low economic growth forecast. In the case of some conservation measures, such as those involving automobiles, the impact on particular fuels can be identified but in general the impact of conservation measures is interpreted in terms of a reduction in total energy use rather than a particular source of supply. It is concluded that an energy conservation target of less than 3.5% annual growth in primary energy demand to 1985 is clearly attainable. Attainment of a national primary energy growth rate of 2%/y averaged over 1975-1990 appears feasible. The personal automobile and space heating have been the two specific areas of energy consumption offering significant conservation opportunities. Industrial energy use offers opportunities through measures that are within the bounds of normal commercial practice. 3 figs., 14 tabs.

19679 **(SCC—8307) The Conserver Society revisited.** Schrecker, T. (Science Council of Canada, Ottawa, Ontario. Committee on Industrial Policies). 1983. 52p. (In French). (MICROLOG—84-2771; CE—02388). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A discussion paper is presented on the applicability of the "conserver society" concept to Canada. Such a concept involves phenomena as increasing energy efficiency throughout society, encouraging energy conservation and use of renewable resources, and promoting life styles not needing a large consumption of goods or energy. Recent encouraging signs of energy conservation trends in Canada are offset by lags in the application of state of the art energy efficiency techniques in construction and manufacturing. Institutional barriers, such as division of conservation costs between building owners and renters, are also mentioned. Some institutional innovations are being implemented to overcome these constraints, however. Renewable energy options considered in this paper are limited to solar thermal energy and biomass. Waste recycling is also considered as an area of considerable potential. Renewable resources in Canada include forests and water, and expenditures to conserve these resources are seen as essential investments for the future, especially in view of the fact that impacts take years to appear. In the economic sphere, a number of developments are outlined, relating to conserver technologies (e.g. those that reduce environmental impacts while recovering materials or energy) and industries. The effect of conserver strategies on employment is also examined. A separate section of this report discusses Quebec, its cultural development and its approach to the conserver society; government actions have been taken with respect to forests, agricultural land, home energy use, recycling, and changing of public attitudes. 50 refs.

19680 **(SERI/TR—254-3387) Small business energy conservation programs: A literature review.** Farhar, B.C.; Fitzpatrick, C. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1989. Contract AC02-83CH10093. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000873/JAW.

This report reviews the literature on commercial energy end users and energy conservation programs in the United States. It examines the literature on small business motivations and barriers in implementing energy conservation measures, and describes programs aimed at inducing energy efficiency in the commercial sector. The report's premise is that energy programs that take the motivations and barriers of small businesses into account will be most effective. The types of programs reviewed include energy service programs such as audits and workshops, financial incentive programs such as rebates and loans, rate research or incentive programs, and demonstration projects. The literature provides encouragement to program implementers that small commercial customers can be reached and motivated by effectively designed programs. 43 refs., 2 figs,. 4 tabs.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 19696, 19792, 20499, 20500

19681 **(DOE/EIA—0035(88/11)) Monthly energy review, November 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 27 Feb 1989. 146p. NTIS, PC A07/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89007731/JAW.

This monthly review provides statistical data on all aspects of energy. Such topics as petroleum, natural gas, oil and gas resource development, coal, electric utilities, nuclear, price, and international production and consumption of energy are included. Supply and demand and prices are detailed. A special future article on fuel switching in 1985 is included in this issue.

19682 **(KEMA—62337-WPB-86-923) Research on renewable energy. Final report on phase 1 'State-of-the art to 1995' of the study 'Technical and economical developments in public electric power supplies in The Netherlands'.** Van Wunnink, A.W. (Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands)). Dec 1986. 19p. (In Dutch). N.V. KEMA, P.O. Box 9035, 6800 ET Arnhem, Netherlands.

Planning of electric power supplies in The Netherlands for 1995, as specified in the 'Electric power supply plan', has been approved by the Ministry of Economic Affairs. Electric power production will meet the expected demand at that time. Diversification in types of units will guarantee electric power generation with minimized costs. Outlined are the different types of the production units with emphasis on more promising types, e.g. coal-fired units and combined-cycle power plants; those types will contribute also to the desirable diversification of fuels. Increased efficiency of gas-fired units will result in substantial energy conservation. The promising options mentioned above can be used for combined heat and power plants also. CHP units have a sound market potential although further market penetration is hampered by low fuel prices and regulations in the sector district heating. Planned power capacities in 1995: coal-fired 4700 MW; gas-fired 8700 MW; and nuclear power 500 MW. 6 figs., 1 tab.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 19678, 19679, 19685

19683 **(DOE/ER/35015—T1) US-Brazil Presidential Panel on Science and Technology.** Bromley, D.A.; Pavan, C. (U.S.-Brazil Presidential Panel on Science and Technology (USA)). 24 Jul 1987. Contract AI01-87ER35015. 134p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007810/JAW.

The Panel that you established pursuant to decisions reached in September 1986 by Presidents Sarney and Reagan during their meeting in Washington has now held its second meeting, in Washington, on July 23-24, 1987. We take pleasure in reporting to you our final recommendations for "topics for bilateral cooperation in science and technology, focusing on selected priority areas of mutual strength and benefit" as requested in your joint charge to this Panel. We shall not repeat herein many of the comments and discussions that were part of our original joint letter to you, dated April 15, 1987, reporting the results of our initial meeting in Rio de Janeiro but incorporate all of that letter - herein by reference.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 19208, 19220, 19244, 19247, 19681, 19681, 19681

19684 **(CANMET—7906) Liquid fuels from Canadian coals.** Taylor, G.W. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1979. 51p. (CE—02052). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper presents a review of the production of liquid fuels from coals in the Canadian context. For liquid fuel production, oil sands and heavy oils currently appear more attractive than coal as alternatives to conventional crude oil, but the magnitude of their economic advantage is uncertain. Many variations on the three basic liquefaction routes--hydro-liquefaction, pyrolysis and synthesis--are under investigation and the technology is advancing rapidly. In the Canadian context, each process has merit under certain circumstances. Based on current understanding of the available coals, surface-mineable subbituminous and lignite coals of Alberta and Saskatchewan appear to offer the best combination of favourable properties, deposit size and mining cost, but other deposits in Alberta, Nova Scotia and British Columbia should not be ruled out. Maritime coals deserve special consideration to meet regional needs arising from total reliance on imported crude. The research effort in Canada is small by world standards, but it is unlikely that technology could be imported that is ideally suited to Canadian conditions. Innovation or process modification to suit Canadian coals and markets is preferred. Coprocessing of coals with bitumen or heavy oils would be a uniquely Canadian, exportable technology. The cost of synthetic crude from coal in Canada is uncertain, estimates ranging from $18 to $35/bbl. Existing economic evaluations vary widely depending on assumptions, and can be misleading. Product quality is an important consideration. Several priority areas for research and development are identified. Of particular importance are basic engineering, hydrogen supply, coal quality and environmental impact. The main considerations bearing on research and pilot plant strategies are discussed. 17 figs., 5 tabs.

2960 Electric Power

REFER ALSO TO CITATION(S) 19665, 19668, 19682, 19696, 19771, 19772, 20499

19685 **(APUB—8812) Alberta Power Ltd., Edmonton Power and TransAlta Utilities Corporation. Decision E88080.** (Alberta Public Utilities Board, Edmonton (Canada)). 1988. 118p. (CE—02345). Alberta Legislative Library, 216 Legislature Bldg., Edmonton, AB, Canada T5K 2B6; $N/C.

A hearing was held before the Alberta Public Utilities Board to consider an application for orders adjusting previously-forecast prices for electricity sold by three Alberta utilities. Issues considered at the hearing, and Board findings related to these issues, are described in this report. These issues are total utility costs, including working capital, adminstration charges, and depreciation expense; functionalization of costs upstream and downstream; classification of costs to demand and energy, for both production plant and transmission plant; and allocation of upstream costs to consumer groups, including determination of demand, interruptible loads, and transmission costs. Rate schedules are also included which relate to the Board's decision. 16 tabs.

19686 **(EMR/E—1988) Electric power in Canada, 1987.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Energy Sector). 1988. 128p. (CE—02306). Electrical Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C.

The electric power industry in Canada is described and its place in the international context is outlined. Information is also included on transmission facilities and major interconnections with the USA. Statistical data are presented on various aspects of the industry, including power generating capacity, power produced and consumed, patterns of power use and consumption, electricity imports and exports, electric utility investment and financing, forecasts of demand and of generating capacity, electricity costing and pricing, and hydroelectric power potential. The regulatory structure for the electric power industry in Canada is also outlined, and processes used in federal and provincial jurisdictions for conducting environmental assessments are reviewed. Includes glossary. 80 figs., 21 tabs.

19687 **(EPRI-EN—6249) Potential impacts of climate change on electric utilities: Final report.** Linder, K.P.; Gibbs, M.J.; Inglis, M.R. (Electric Power Research Inst., Palo Alto, CA (USA); ICF, Inc., Fairfax, VA (USA)). Jan 1989. 128p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008467/JAW.

This report describes an analysis of the potential impacts of greenhouse-gas-induced climate on electric utility planning and operations. A case study approach was used; utility systems in the Southeastern US and New York State were analyzed over the period 1986 to 2015. Principal tasks were: (1) the development of alternate climate change (i.e. temperature change) scenarios reflecting the diversity in current general circulation model (GCM) outputs, (2) estimation of the temperature-sensitivity of electricity demand and supply, and (3) comparison of utility investment and operating decisions subject to the alternate climate change scenarios. The findings indicate that climate change could lead to: (1) increased electric generating capacity requirements, (2) increased generation of electricity, (3) decreased availability of hydroelectric generation resources, and (4) increased annual electricity production costs. Utility planners should start now to consider climate

change as a factor affecting their planning analyses and decisions. Large impacts are not imminent, but the importance of climate change is likely to increase over time. Climate change is likely to increase the uncertainties utility planners must address. Correctly anticipating climate change and planning for it can reduce its impacts on future utility investment and operating costs. 24 figs., 48 tabs.

19688 **(ESC-WR—88-30) Marginal costs as a basis for tariff structures of electric power.** Scheele, D. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Dec 1988. 74p. (In Dutch). Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

There are several fundamentally different calculation methods to determine costs of electric power generation. More than one point of view is appropriate to study these methods. Distinctions are made between analysis for which the main point lies in objects outside of the electric power sector and analysis which relates the functioning of the electric power sector to different calculation methods. The market conformity of the electric power sector, an internal object, is highlighted in this study. Two views of the causing principle are opposed and evaluated to what extent they anticipate the market orientation of the sector. Special attention is paid to the dynamic view of the causing principle. The essence of that view is to confront the consumer with future collective costs to be made or to be prevented as a result of action from the demand sector (distribution companies, self-generators, end consumers). By action is meant electric power conservation, self-generation, reimbursement or return of electric power. Different aspects with regard to marginal-cost pricing and time-of-use pricing are dealt with for the Dutch situation. 30 figs., 11 refs., 11 tabs., 3 apps.

19689 **(IVO-A—01/88) Load management experiences in thermomechanical pulping.** Sormunen, R.; Stroemberg, M. (Imatran Voima Oy, Helsinki (Finland)). Sep 1988. 105p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757042/JAW.

The two-part report summarizes the results of research done over two years with the goal of evaluating preliminarily the suitability of thermo-mechanical pulp plants for load management purposes. The basic idea is peak clipping at the supply side by utilizing the refining over-capacity and storage possibilities at the end-use side. The actual control of loads would take place in real time from the supply side with the principle of interruptible loads. The first part of the report is a background representation, giving a review of the mechanical grinding and refining techniques applied in the Finnish paper industry, their current extent and estimated development. The main conclusion is the expected rapid increase in thermomechanical pulp (TMP) production. This in turn, because the refining process is very electricity-intensive and unit loads are large - from 10 to 15 MW - means first a significant addition for power generation need, but gives at the same time good provisions for load management applications. The main emphasis of the work lays in the second part of the report, which concludes the results of practical rest runs of a TMP-plant according to simulated load management schemes. The main purpose of the runs was to gather data and experiences from the possible quality changes in pulp production and disturbances in energy balance of power plant, TMP-plant and paper machine combination due to unperiodic operation of the TMP-plant. No serious obstacles were discovered. The conclusions have furthered to the negotiations between Imatran Voima Oy - the largest, state-owned power company in Finland - an Enso-Gutzeit Oy - the largest, state-owned paper company in Finland - for making a commercial agreement for the operation of Enso-Gutzeit's TMP-plants according to the load management needs of Imatran Voima Oy.

19690 **(IVO-A—10/87) Economy of remote-controlled electric space heating and effects on living comfort.** Martikainen, L.; Eerola, P.; Remes, M. (Imatran Voima Oy, Helsinki (Finland)). Dec 1987. 211p. (In Finnish). NTIS (US Sales Only), PC A10. Order Number DE88757045/JAW.

This study examines the effects of the interruption of electric space heating - expecially 'direct electric space heating' - on living comfort, levelling of electrical load variations and quality of electricity in a low-voltage distribution network. The research was carried out by means of field measurements in real conditions, laboratory tests and simulation calculations. In addition, opinions of electricity consumers and distribution utilities applying remote load control were surveyed electric space heating on interruption and its development needs. The changes in living comfort during interruption were followed up in three new single-family houses of different types. Measurements showed that, in view of thermal comfort, the most critical factor for heating interruption is a decrease in the operative temperature. This allows a maximum interruption of 1.5 hours during the coldest season. Electrical power measurements indicate that even at the coldest temperatures of -30 deg C, the controllable heating demand of modern well-insulated houses are low, typically under 4 kW in a house of about 120 m/sup 2/. The payback peak after control period, 5-8 kW in height and 20-40 minutes in duration, reduces the levelling efficiency so that with 1-2 hours' interruption periods the net gain is 1-2 kW in the contracted demand of a distributing utility. The load control is economically profitable for consumers, while many distributing companies credit of the control more than they profit from the rebat of their electricity purchase costs. Regarding the national economy, the load control of direct electric space heating is marginally profitable if the investments of the control system are justified otherwise, too.

19691 **(NBEPC—1988) The New Brunswick Electric Power Commission, annual report, 1987-1988.** (New Brunswick Electric Power Commission, Fredericton (Canada)). 1988. 35p. (In French). (MICROLOG—88-06291). New Brunswick Electric Power Commission, 515 King St., Fredericton, NB, Canada E3B 4X1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report summarizes the year's activities of the provincial body responsible for generating and distributing electrical power in New Brunswick. Highlights for the year include a 4.8% increase in energy sales, an increase in industrial consumption of 6.5%, the signing of a major firm energy and capacity contract between New Brunswick Power and Hydro-Quebec, and the signing of the Canada/New Brunswick Agreement on a Sulphur Dioxide Reduction Program. Data are given on provincial power sources and power demand, sources and distribution of revenue, energy sales and prices, and performance of the Point Lepreau power reactor. Investigations into new fuels for thermal power plants are outlined. Financial statements are also included.

19692 **(NEDOJ—8801) Report on the present status of the load control and electricity charges system in the US and the load consumed by large consumers in Japan.** (New Energy and Industrial Technology Development Organization, Tokyo (Japan)). Mar 1988. 59p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756476/JAW.

The annual load factor decreased due to an increase in the maximum power demand and a widening gap in demand between daytime and nighttime constitute the factor inhibiting the introduction of nuclear power as a base power supply. To inhibit the maximum power demand, promote midnight demand, and thus improve the load factor, a team from the New Energy Development Organization visited the US, which is an advanced country in terms of load control, to carry out a survey on the present status of the study and introduction of the concentrated load control system. This system consists of the control of load equipment of consumers by an electric power company. Most systems of this kind in practical use in the US are directly controlled by using wireless-type control switches installed on the load equipment. The use of this switch is cost-saving but unidirectional. Attempts are being made for research and development concerning a total system capable of bidirectional, communication that allows the automatic control of distribution equipment as well as load control. The above organization also made a survey on the present status of loads, consumed by large consumers in Japan, by season and time zone and the measures that they take for load adjustments. (15 figs, 14 tabs, 7 photos)

19693 **(OH—8804) Ontario Hydro annual report,1987.** (Ontario Hydro, Toronto (Canada)). 1988. 47p. (MICROLOG—89-00252). Ontario Hydro Research Division, Research Publications Office, 800 Kipling Ave., Toronto, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Ontario Hydro is a provincial crown corporation with broad powers to generate, supply and deliver electricity throughout the province. This report provides a history and description of the current electric power generation, transmission and distribution system of Ontario Hydro, its role in the proviincial economy, and its programs in environmental control, international cooperation, development of resources and services, energy conservation, rate structure, public safety, and personnel management. Statistical data are presented, where applicable, in graphic form. The most significant seciton of the report is devoted to financial information, with important points summarized. Data on production, assets, and liabilities are given in both graphic and tabular form. 33 figs., 4 tabs.

19694 **(ORNL/CON—272) Uncertainty in long-term resource planning for electric utilities.** Hirst, E.; Schweitzer, M. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 73p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007858/JAW.

This report applies the basic tenets of decision analysis to the resource problems faced by electric utilities. The report is aimed primarily at managers and executives in electric utilities and in state regulatory commissions, and secondarily at the analytical staffs in such organizations. Our aim is to increase awareness of the importance of uncertainty in utility planning, to demonstrate the value of different methods for treating uncertainty in planning, and to identify additional analysis and data needed to improve utility planning processes. Although various analytical approaches are discussed, the report is not a technical treatise and does not break new ground in the areas of operations research, applied mathematics, or decision sciences. The next chapter presents a hypothetical example of how explicit consideration of uncertainties can assist in deciding among alternative resources. Chapter 3 discusses the various uncertainties facing utilities. Chapter 4 discusses alternative approaches to managing uncertainties in the decision-making process (i.e., the types of actions utilities can take to deal with uncertainty). Chapter 5 discusses the methods that utilities currently use in their analysis of alternative resources (especially in their development of long-term resource plans). Chapter 6 describes how utility plans are implemented and updated. And the last chapter suggests additional work that would improve our understanding of the uncertainties that affect utility planning. 66 refs., 13 figs., 15 tabs.

19695 (SEG—8811, pp 54) **Inter-fuel competition in central Canada electricity.** Harper, W.O. (Ontario Hydro, Toronto). 1988. Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, AB, Canada T2R 1N7; $187.00 CAN. (CONF-8811178—; CE—02362).

From 8. annual energy pricing conference; Toronto, Canada (7 Nov 1988).

This paper examines the historic role of electric utilities in Ontario and how Ontario Hydro has fulfilled this role, presents a review of Ontario Hydro's current supply/demand situation and proposed planning strategy, and describes some major initiatives taken to meet future electricity needs and customers' expectations. Electric utilities in the past have tended to concentrate on producing reliable power at lowest cost, but the recent trend is toward providing higher levels of customer service, in accordance with consumer attitudes towards electricity as a service rather than a commodity. The decline in power demand from the recession of 1981-82, plus the cumulative effect of years of promoting energy conservation, has led to Ontario Hydro finding itself with an overcapacity. This has brought about a policy of marketing electricity to increase its market share, and a planning policy that takes into account the long lead-times for approval of new facilities, the needs of the public, and the need to shape demand. Future demand will be met not only by increasing capacity, but also by reducing existing demands and pursuing non-traditional sources of power, such as non-utility power generation from small hydro plants, waste-fired plants, and cogeneration. The biggest contribution to meeting demand will be through various means of demand management, such as increasing efficiency, using time-of-use rate structures, and giving financial assistance to those purchasing energy efficient equipment. 7 figs., 1 tab.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 19677, 19737, 19739

19696 **(DOE/EIA—0226(88/12)) Electric Power Monthly, December 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 9 Mar 1989. 50p. NTIS, PC A03/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89008485/JAW.

The Electric Power Monthly (EPM) focuses on the electric utility industry in the United States. Detailed, plant level data are contained in the Electric Power Quarterly. The data in this report are presented for a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. The Energy Information Administration (EIA) collected the information in this report to fulfill its data collection and dissemination responsibilities. 27 tabs.

19697 **(MAW—8503) A guide to the sources of energy use statistics for the industrial, commercial, agricultural and institutional sectors of the Canadian economy. Phase 2.** (Matthews (W.G.) Associates Ltd., Ottawa, Ontario (Canada)). 1985. 210p. (CE—02369). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The intent of this report is to provide a detailed and comprehensive description of the current data available on energy consumption in selected sectors in Canada. These sectors are the industrial sector--mainly fishing/trapping, logging/forestry, mining, manufacturing, and construction--agriculture (including all types of farm operations and agricultural service industries) and the commerical/institutional sector (excluding government or public administration). Summaries of the sources of energy use information are presented according to source agency and individual energy commodity. Data bases are assessed according to the kinds of data collected, collection methods, availability, quality, coverage, format of presentation and units used, timeliness, and usefulness for analysis and forecasting. A separate section of the report discusses some of the problems with the data available, such as standardization of data codes, data gaps, lack of detail, and reconciliation of different data sources. 36 tabs.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 19454, 19460, 19461, 19499, 19528, 19679

19698 **(BOUWCENTRUM—11430) Energy demand in the built environment. Study A, phase 1.** De Vries, G.; Weerdenburg, M.J. (Bouwcentrum, Rotterdam (Netherlands)). Oct 1986. 83p. (In Dutch). Bouwcentrum BV, P.O. Box 299, 3000 AG Rotterdam, Netherlands.

Research is carried out to the extent in which renewable energy sources in the Netherlands can meet the energy demand for the year 2050. The state of the art of technologies concerning thermal insulation, boiler efficiency and other constructional aspects, heat recovery, passive solar energy, active solar energy, cogeneration, heat pumps and wind energy is discussed. The present energy consumption of family households and the potential contributions of the above-mentioned aspects and renewable energy sources to the energy demand in the Netherlands for the year 2050 is shortly dealt with in the summary. This section study is only related to small-scale energy applications.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 19218

19699 (CONF-890162—) MHD contractors' review meeting. (USDOE Pittsburgh Energy Technology Center, PA). 1989. 302p. NTIS, PC A14 - OSTI. Order Number DE89007028/JAW.

From MHD contractors' review meeting; Pittsburgh, PA, USA (24 Jan 1989).

This report covers the MHD Contractors' Review Meeting of January 24--26, 1989. The topics are covered under four main headings, toping cycle, bottoming cycle, seed recovery/regeneration, and systems engineering and retrofit conceptual design. Individual project titles are processed separately for the database. (JL)

19700 (DOE/ET/15601—29) Diagnostic development and support of MHD test facilities: Technical progress report for the period April, May, June 1987. Shepard, W.S.; Cook, R.L. (Mississippi State Univ., Mississippi State (USA). MHD Energy Center). Jul 1987. Contract AC02-80ET15601. 55p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007591/JAW.

Mississippi State University is developing diagnostic instruments for MHD power train data acquisition and for support of MHD component development test facilities. Microprocessor-controlled optical instruments, initially developed for HRSR support, are being refined, and new systems to measure temperatures and gas-seed-slag stream characteristics are being developed. To further data acquisition and analysis capabilities, the diagnostic systems are being interfaced with MHD Energy Center computers. Additionally, technical support of the diagnostic needs of the national MHD research effort is being provided. 11 refs., 20 figs., 4 tabs.

19701 (WAES-TR—89-0004) Conceptual design of a coal-fired MHD [magnetohydrodynamic] retrofit plant: Quarterly report, July 1988--September 1988. Van Bibber, L.E.; Wiseman, D.A.; Muenchow, H.O.; Holman, R.R.; Bernard, F.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Feb 1989. Contract AC22-87PC79668. 52p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007715/JAW.

The objective of the project is to prepare a site-specific conceptual design of a coal-fired magnetohydrodynamic (MHD) system for retrofit to the Scholz Generating Station, Sneads, Florida. The MHD System includes a topping cycle and bottoming cycle but no integrated seed regeneration system. Provisions for future integration of a seed regeneration system will be made with respect to location at the utility site, waste heat utilization, and materials handling. The conceptual design shall include: process, system, and equipment descriptions, interface identification and requirements, equipment and handling arrangements, an overall plant layout, cost and schedule for the design, fabrication/procurement, and arrangement of each major component, and a critical path for the total system effort. The conceptual design will be in sufficient detail to ensure that the integration of the MHD System with the Scholz Generating Station will be compatible with the utility industry standards for constructability, operability, reliability, and maintainability. 14 figs., 1 tab.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 19662

19702 (CONF-881010—Absts.) 1988 fuel cell seminar: Program and abstracts. (Courtesy Associates, Inc., Washington, DC (USA)). Oct 1988. Contract FG01-88FE61544. 423p. NTIS, PC A18 - OSTI. Order Number DE89004951/JAW.

From 11. fuel cell seminar: development and application of fuel cells for the 90's; Long Beach, CA, USA (23 Oct 1988).

The objective of the initial Seminar was to bring together participants in the major US fuel cell research, development, and demonstration programs: to give participants the opportunity to learn more about the various activities, to make contact with others working towards similar objectives, and to help establish an integrated national program. For the second Seminar, this objective was expanded to increase participation levels by potential users of the technology, including gas and electric utilities as well as industrial, military, and aerospace organizations. Major topics of discussion include: solid oxide fuel cell technology; fuel cell power plant subsystems; poster sessions; fuel cell component research and development; phosphoric acid fuel cell technology; fuel cell applications and economics; low temperature fuel cells for transportation; molten carbonate fuel cell technology. Individual projects are processed separately for the data bases. (CBS)

19703 (LBL-PUB—644) Fuel cell handbook. Kinoshita, K.; McLarnon, F.R.; Cairns, E.J. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 169p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006611/JAW.

The objective of this publication is to update the technical status of fuel-cell technologies for stationary power generation, with the major emphasis being to update the technical advances in phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC), and solid oxide fuel cell (SOFC) technology since about 1980. The emphasis of this handbook is on these fuel-cell systems because they are currently the strongest contenders for commercial stationary power generation. Optimization of parameters such as pressure, temperature, reactant composition and utilization are important to obtain the maximum performance from fuel cells. Because the fuel cell must be integrated with other subsystems involving fuel processing, thermal management and power conditioning, a systems approach to utilizing fuel cells is needed, and several examples are provided. Finally, it is apparent that there are numerous markets where fuel cells can play a prominent role if certain economic and technical issues are resolved. If these issues and the institutional barriers confronting fuel cells are overcome, then fuel-cell technologies should penetrate the commercial and industrial marketplaces.

19704 (PNL-SA—16503) Solid oxide fuel cells: A materials challenge. Bates, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 16p. (CONF-890213—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008127/JAW.

From 16. annual energy technology conference; Washington, DC, USA (28 Feb 1989).

This paper reviews the advantages and disadvantages of solid oxide fuel cells (SOFC), presents a brief history, and describes the state-of-the-technology and the research required for SOFC development. The paper will show that the past and future challenges relate to the selection and development of materials and their fabrication into fuel cells and generators. 9 refs., 5 figs., 1 tab.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 19215, 19254, 19512, 19514, 19516, 19657, 19664, 19677, 19690, 19698, 19929, 20111, 20502, 20537

19705 (A/ENR—NR118) Energy matters, a guide to efficient energy use in the home and in personal transportation. (Alberta Energy and Natural Resources, Edmonton (Canada)). 1979. 32p. (CE—02383). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This guidebook presents information for the Alberta householder interested in conserving energy. Background information is presented on Alberta's energy resources and energy supply and demand patterns. Suggestions are then made on simple methods that can help the homeowner save 30% of current energy use, including increasing furnace efficiency, overcoming heat losses by

proper sealing and insulation, and use of south-facing windows. Factors that affect fuel economy of automobiles are also outlined. 30 figs.

19706 **(AE/PRB—1978) Guidelines for conserving energy in Alberta schools.** (Alberta Education, Edmonton (Canada). Planning and Research Branch). 1978. 51p. (CE—02320). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Recommendations are presented for helping school managers in Alberta to develop effective energy conservation plans for their school buildings. Results of three Alberta Education studies on energy conservation in schools are presented to illustrate the savings possible through energy management, energy-conserving modifications, and energy-conserving design. Steps in designing an energy conservation program are then outlined: conducting an energy inventory, preparing an energy budget, carrying out an energy audit, and preparing an implementation plan for selection and installation of energy conserving measures. Specific energy conserving measures are discussed in the areas of human management practices, maintenance, operating procedures, and modifications to HVAC systems, lighting/electrical systems, water supply systems, and building structure. Guidelines are also presented for the energy-conserving design of new schools. Finally, ways of evaluating the energy conservation program are briefly described. 12 refs.

19707 **(BFR-R—83-1988) Systems technology for natural gas. 1. Condensation problems in flues. 2. Gas apparatus.** Herbert, P.; Aakesson, H. (AaF Energikonsult, Stockholm (SE)). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 73p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757037/JAW.

The objective of the first part of this investigation is to find answers to problems connected with the formation of condensation in flues and to recommend suitable measures against condensation. The second part of the work is concerned with improving knowledge of systems technology for natural gas, and to ascertain what problems are likely to be encountered in connection with the application and suitability of standards and codes of practice. The work has involved studies of the literature and interviews with persons and organisations connected with the supply of natural gas as well as with users. As far as condensation is concerned, there is little problem with its corrosivity: instead, it is mainly moisture that is the problem. It is important to investigate what new materials and methods could be used when modifying existing flues. Better knowledge, too, of the behaviour of flue gases from balanced flue boilers is needed. As far as radiant heaters in large premises are concerned, the question of how to discharge flue gases is of key interest, as is the matter of open flames in certain types of premises. (authors).

19708 **(BFR-R—84-1988) Indoor temperatures and standard climatic year consumption in apartment buildings.** Nordlander, J. (Norrlands Byggtjaenst, Umeaa). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 40p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757038/JAW.

The variations in indoor temperatures between individual apartments in apartment buildings have been investigated. The objective of the work has been to demonstrate by how much the 'standard climatic year' consumption for an indoor temperature of +20 deg C can be affected by the choice of a particular apartment as typical of the indoor temperature throughout the building. The results have shown that the variation in indoor temperature is so great that the wrong choice of 'typical' apartment can give rise to an error of 5% in calculating the standard climatic year consumption. The work has also revealed a poor correlation with apartment indoor temperatures. The difference in savings was also affected by the choice of apartment used as the typical temperature reference. Selection of a standard climatic year is not entirely consistent and unambiguous, and can have some effect on the results.

19709 **(BOUWCENTRUM—11749) Local heating based on the KWR dwellings registration. Final report.** Smit-Den Adel, J.M. (Bouwcentrum, Rotterdam (Netherlands)). Dec 1987. 44p. (In Dutch). Bouwcentrum BV, P.O. Box 299, 3000 AG Rotterdam, Netherlands.

Ideas, demands and attitudes of occupants of dwellings in the Netherlands with regard to heating and ventilation have been inventorised. The dwellings are heated by so-called local heating. The aim is to gain insight into the possibility to combine local heating with architectural and energetical improvements of dwellings. The results of the inquiry are discussed extensively. First characteristics of the occupants, the dwellings and satisfaction of the occupants with regard to the dwellings are dealt with. Then some energetic aspects (insolation, specifications of the rooms) are discussed. Subsequently technical specifications of the dwellings are mentioned. Finally the attitudes of the occupants concerning the use of the heating systems and ventilation are considered. 9 tabs., 4 apps.

19710 (CGA—1988, pp 13) **The role of new technology in recapturing the multi-family market.** Carey, R.L. (Union Gas Ltd.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

During the 1960s, natural gas was the primary energy used in multi-unit high-rise buildings for space and water heating; space heating done by means of a central boiler system. Following the higher energy prices and consequent rent controls, developers looked for ways to pass energy cost directly to the tenants. Municipal electric utilities promoted individual electric metering as an answer which led to the growth of electric heating. Rent controls are still in place. The resulting shift of the high-rise market to condominiums has created an opportunity for the gas industry, and a demand for quiet, reliable in-suite heating/cooling systems. An integrated heating/cooling unit marketed by Magic-Chef, called the Magic-Pak, is a through-the-wall unit available with gas or electric heating; however, the gas unit is only marginally more expensive to install than the electric unit. Challenges to the gas industry are summarized as: gas heating/electric cooling equipment must be cost competitive; individual gas metering is a necessity; gas utility facilities inside buildings are not covered by any code; heating/cooling equipment and the gas facilities must be acceptable to the developer or owner; and the municipal electric utilities in Ontario have developed practices meant to protect this market. Examples of high-rise buildings serviced by Union Gas are cited.

19711 (CGA—1988, pp 12) **Indoor air quality: market opportunity or impediment?.** Blackmore, G. (KeepRite, Inc.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

Indoor air quality (IAQ) is spotlighted in this paper; air in which there is no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction. Nine main indoor pollutants are cited: formaldehyde, radon, carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide, respirable suspended particulates, moisture, and organic solvents. Both sources and health side effects of these pollutants are explained. Source control is the best method to combat poor indoor air quality, but not necessarily practical for all pollutants. The use of continuous air and vapour barriers in interior walls, ceilings, and floors can keep some from entering the building structure. Indoor air filtration exists in forced air heating systems. Non forced air systems depend on local filtration. Controlled ventilation is the best current solution to reducing pollutant gas concentrations. When combustion air is supplied by the interior space without benefit of power venting, then normal operation results in some spillage of pollutants into the space for a short period at start-up. This potential IAQ problem can be solved by having air make-up tied to the use of the exhaust devices, or to use combustion appliances that are power vented or direct vented. Thus the author perceives the need to promote the gas industry and the IAQ advantage of distributed,

gas-forced air heating systems. Other marketing targets should include power vented and direct vent gas appliances, integrated ventilation with gas products, co-operation with contractors and manufacturers to approve and install products at the lowest cost, and increased knowledge of the principles of good IAQ installations.

19712 (CGA—1988, pp vp) **Housing market trends in the 1990s.** Clayton, F.A. (Clayton Research Associates). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

This paper provides insight into the expected nature of the housing market in Canada in the 1990s. Future household growth and the demand for additional housing, is critically dependent on the level of immigration. If immigration rises during the decade, the amount of new housing built could equal or even exceed the 1980s number. Canadians have exhibited a strong preference for home ownership. It is likely that the demand for new housing will continue to be focussed on ownership forms of housing. The new housing industry is discovering that here are many needs and desires which can be satisfied through appropriately designed housing beyond those satisfied by the traditional housing forms. As a result, there is an increasingly important new market segment emerging, that of the lifestyle living environment. There has become a greater emphasis on quality, distinctiveness, and value in the new homebuyer's decision to purchase, but a decline in the average size of a new single-family homes is likely. An increase in the Smart House concept of construction is predicted where an interaction among appliances is possiblee since everything is powered by a central wiring system. Renovation spending is also expected to continue to rise during the 1990s. Innovative thought in meeting the future homebuyer needs is crucial. 2 tabs.

19713 (CGA—1988, pp 4) **Smart House: the next frontier in housing.** Gilles, T.C. (Lennox Industries, Inc., Dallas, TX). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

The Smart House project originated in the United States by the National Association of Home Builders Research Foundation in 1984 as a result of investigation into the current methods used in wiring single family residences. The wiring system utilized in this home provides service to all functions at any convenience outlet at any point in the home. Outlets will be a multifunction outlet where the connector plug from the respective device will be a single service component. The system utilizes an intelligent electronic chip in all of the devices in the home, and a control function known as a closed loop power system. When the appropriate device is inserted into the intelligent receptacle, a signal is transmitted from the device on the control circuit to a power control centre that can determine what the device is. At that point the appropriate circuit is activated to the device. If at any time an abnormal condition occurs, the circuit is interrupted. All gas is handled through a distribution network from one or more distribution manifolds within the home. This manifold is controlled by an intelligent control circuit much in the same manner as the electric system. The laboratory home in Maryland is equipped with forced air gas-fired heating, a feature hopefully to be duplicated in Canada. The Smart House concept will offer lower operating costs, greater safety and higher resale value.

19714 (CMHC/PDRS—8412) **The combustion ventilation safety check.** (Canada Mortgage and Housing Corp., Ottawa. Policy Development and Research Sector). 1984. 158p. (CE—02376). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document presents information to assist the homeowner in performing safety checkups on residential systems relating to heating and ventilation. The first part is a combustion ventilation safety check, designed for use in houses with oil or gas fired heating systems. The purpose of the check is to determine if potential exists for pollution of indoor air by heating appliances or fireplaces. The check can be used to identify most types of combustion ventilation hazards in housing, including backdrafting, leaky heat exchangers, spillage from chimneys, carbon monoxide production, and hazards due to over-firing of a gas appliance. The second part is a safe chimney performance test, and is for use by householders who want to know whether hazardous chimney backdrafting or spillage might occur in their houses. The third part is a background document summarizing much of the research on the design of the first test. Its intent is to discuss, in general terms, the entire range of combustion ventilation problems that might be encountered in a home. Types of failures are classified, and some of the specific contributing factors are described. Also included is a discussion on the relative frequency and severity of each ventilation hazard. The different procedures that can be used for identifying any particular problem are outlined and evaluated, and the most appropriate remedial measures to be considered for each potential failure are identified. 8 refs., 22 figs., 1 tab.

19715 (CONF-870854—2) **Survey of the air-conditioning industry.** Wurm, J.; Biederman, R. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 6p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007170/JAW.

From 17. international congress of refrigeration; Vienna, Austria (24 Aug 1987).

The air-conditioning (AC) branch of the refrigeration industry has undergone a period of significant development fueled by open markets, broadened international competition, and increased energy awareness. The average consumer is likely to benefit today as much as during the 1930's, when the foundation for mass usage of air conditioning was established. The focus of this survey is to present recent developments in the AC market and look ahead to further advancements and opportunities for growth. 8 refs.

19716 (CONF-890105—6) **Diurnal ice storage cooling systems for Army facilities.** Sohn, C.W.; Tomlinson, J.J. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006686/JAW.

From ASHRAE winter symposium; Chicago, IL, USA (28 Jan 1989).

The US Army's experience with diurnal ice storage (DIS) cooling systems for one of its facilities is discussed in this paper. A few favorable characteristics of an Army post for the application of storage cooling systems are identified. A nominal 900 ton-hour (t-h) ice-in-tank DIS cooling system was installed at Ft. Stewart, GA, and has been in operation since March 1987 to demonstrate the applicability of DIS cooling systems to Army facilities. Information on the design, construction, operation, and performance of the Ft. Stewart DIS cooling system is presented. 7 refs., 9 figs., 3 tabs.

19717 (DOE/CE/89000—T2) **BEMA - Building Energy Monitoring Analysis: A short-term measurement of building thermal performance: [Final report].** Duffy, J.J.; Saunders, D.; Spears, J. (NAHB Research Foundation, Inc., Upper Marlboro, MD (USA)). [1989]. Contract AC03-83CE89000. 332p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008285/JAW.

The report titled "BEMA - Building Energy Monitoring Analysis: A Short-Term Measurement of Building Thermal Performance" represents the work during the period October 1987 through October 1988. Also enclosed is a list of meetings, seminars and workshops conducted during the same period and the final financial report. View graphs for the ASHRAE conference in Ottawa are also enclosed. The purpose of this project is to transfer the short-term monitoring technology to the private sector. To that end, NAHB/NRC has developed a program which is being funded by New York Energy Research and Development Authority to commercialize the technology developed under the DOE contract. Enclosed is a brief discussion of the project and our collaboration with SERI on the project.

19718 **(EI—8205) Energy conservation building operations demonstration for gas-heated high-rise multiple-unit residential buildings. Part 1, executive summary.** (Engineering Interface Ltd., Willowdale, Ontario (Canada)). 1982. 199p. (CE—02390). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A pilot project was set up in Ontario to gauge the effectiveness of using a system of building owner/manager workshops to improve energy management in highrise residential buildings. Groups of owners, managers and superintendents representing a total of ten rental and ten condominium buildings assembled for the first workshop, then returned at about one-month intervals for feedback and additional instruction. The selection of energy measures to implement was assisted by computerized audits of historical energy use in the buildings, and the effectiveness of the measure was tracked by computerized monitoring of ongoing energy use. Results of the program show that overall energy use for condominiums and rentals for the first year was reduced by 4.5 and 6.8% respectively. Of the buildings which completed the project, 6 of the 9 condominiums achieved a saving, while 8 of 9 rentals were successful. Failures among the condominiums were mainly due to human factors (lack of interest) and the one rental energy increase occurred in a building plagued with mechanical and electrical problems. The workshop approach was seen to be an effecive way of achieving lasting conservation results. There was a stronger correlation of achievement with the level of effort applied by participants than with previous energy use levels by the buildings. Problem issues raised at the workshops included inability to achieve an appropriate return on energy conservation investments, incompatibility of municipal ventilation codes with energy conservation, and the need for submetering to control energy use in individual dwelling units. 26 figs., 29 tabs.

19719 **(EMR/ECOS—BETT82) Index of BETT's [Building Energy Technology Transfer] reports.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Energy Conservation and Oil Substitution Branch). 1982. 14p. (CE—02427). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Buildings Energy Technology Transfer (BETT) program was instigated by Energy, Mines and Resources Canada to investigate various aspects of energy conservation and management in different kinds of buildings. A number of reports were published in order to facilitate transfer of new energy saving technologies, and an index to these reports is provided by this document. Reports are listed by investigating agency: Ontario Research Foundation, Saskatchewan Research Council, University of Waterloo, University of Manitoba, and Concordia University.

19720 **(EMR/RE—ER81-1E) Passive solar remodelling. A feasibility and design study to assess methods of residential passive solar energy collection and utilization.** Bryenton, R.W.; Cooper, K.A.; Chantler, T.; Shea, M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Renewable Energy Resources Branch). 1981. 192p. (MICROLOG—82-3714; CE—02112). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Four oil-heated and six gas heated houses in Vancouver were selected and analyzed for energy use. Heat loss and annual fuel use calculations were performed and compared to actual fuel use data for 1978. Recalculation of heat loss and annual fuel use was made and the energy savings determined assuming the houses had been re-insulated to levels 1978 recommended. Cost data were developed and applied to determine the capital cost of energy saved by each measure of re-insulation. Four houses were selected and analyzed further: three for super-insulation cost and benefit, and one as an actual passive solar remodel to be used to verify the assumptions used later in evaluation of the costs and benefits of passive solar measures. One house was selected for thorough cost-benefit analysis for intermediate levels of energy conservation from re-insulation, heating equipment and temperature setpoint changes. Passive solar measures were evaluated in detail for this dwelling. The passive measures were evaluated for cost and benefit at various levels of dwelling heat loss and furnace size and the capital cost of energy provided by the passive measures determined. It was seen that energy conservation measures equivalent in cost to new oil sands projects can reduce present energy consumption in houses by 50% to 75%. Passive solar measures applied during the addition of new south walls in the form of direct gain systems are almost as inexpensive as the re-insulation of existing stud walls. Night insulated direct gain systems added to existing dwellings compete in cost with new frontier oil if low cost night insulation can be used. 21 refs., 31 figs., 7 tabs.

19721 **(EPRI-CU—6243) Photoelectric control of daylight-following lighting systems: Daylight-sensing photocell placement: Final report.** Verderber, R.R. (Electric Power Research Inst., Palo Alto, CA (USA); Lawrence Berkeley Lab., CA (USA)). Mar 1989. Contract AC03-76SF00098. 104p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

Automatically dimming electric lights when daylight is available can help trim commercial building energy demand. This study evaluated control strategies and documented the ability of different control systems to maintain proper lighting at a workstation for various daylight levels and room geometries. Because daylight availability coincides with peak demand times for many utilities, shifting part of the lighting requirement from electricity to daylight can support load management efforts. To reduce power demand while maintaining illumination at the design level, photoelectric controls must dim the electric lighting systems in precise response to the available daylight. This study explores the equipment and methods required to achieve this balance. 8 refs., 45 figs., 4 tabs.

19722 **(EPRI-CU—6257) Radon control strategies for residential dwellings: Final report.** Fortmann, R.C.; Schoenborn, W.A.; Nagda, N.L. (Electric Power Research Inst., Palo Alto, CA (USA); GEOMET Technologies, Inc., Germantown, MD (USA)). Feb 1989. 54p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008411/JAW.

This report reviews available radon control strategies for residential dwellings. It was prepared in conjunction with GEOMET's experimental testing of radon and radon progeny control strategies at the GEOMET research houses. The methods for controlling indoor radon include soil ventilation, subslab ventilation, ventilation of hollow blockwalls, sealing of radon entry routes, natural and forced air ventilation of indoor air, water filtration, and air filtration. The most effective technique will vary depending upon a variety of conditions that are unique to each home, such as local geology, type of structure, and ambient radon levels. Mitigation systems that require ventilation of the subslab, soil, or hollow blockwalls have high installation costs but are usually very effective. Systems that require ventilation of the indoor air are relatively inexpensive to install but can have moderate operating cost and limited applicability. Selection of a mitigation system depends on a combination of objective and subjective variables such as the magnitude of the problem, house architecture, homeowner budget, system aesthetics, and insight from both the contractor and radon diagnostician. 56 refs., 12 figs., 7 tabs.

19723 **(FRNC-TH—3387) Determination by cryogenic probe of soil ability to restore or store the heat: testing device, experiment and modeling.** El Kadiri, M. (Toulouse-3 Univ., 31 (France); Institut National des Sciences Appliquees (INSA), 31 - Toulouse (France); Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 278p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88756972/JAW.

The heat recovery or storage in the ground may be largely enhanced by using the soil as a cold or hot source for a heat pump below 0 degree C. This extension to negative temperatures is set through the utilization of the water phase change latent heat. An experimental study had been cnducted with various soils, saturated or not, and the ability to undergo successive frost-defrost cycles is examined.

19724 **(FRNC-TH—3390) Contribution to the study of energy transfer in polyphasic media. Application to complex systems making renewable energy valuable.** Soulas, M. (Angers Univ., 49 (France); Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 320p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756970/JAW.

The heat and mass transfers in non-reversible processes for energy transfers induced by heat sinks in various media (multiphase porous systems, condensable or not condensable gaseous media) are studied. The grain size of the porous media is found to determine the exchange mode (conductivity, connection or phase changing). The theoretical concepts are then applied to a new system composed of a direct expansion heat pump with atmosphere (gaseous system) or ground (porous system) as heat sources, and a direct condensation heating floor as a condenser. Performances of this system are shown to be superior to the classic system performances.

19725 **(FRNC-TH—3397) Economic optimization of thermal design in new housings.** Berete, I. (Centre Scientifique et Technique du Batiment, 75 - Paris (France); Ecole Nationale des Ponts et Chaussees (ENPC), 75 - Paris (France)). 1985. 149p. (In French). (CSTB-R—93186-L). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756971/JAW.

The energy consumptions and heat requirements of a building are analyzed, considering the building envelope, the dweller's behaviour, space heating and hot water production for domestic use. The energy balance of the building is then followed by an economic analysis taking in account actuarial price calculations. A global optimization model is proposed with thermal, economical and mathematical optimization sub-models.

19726 **(HWC—82-EHD-83) An investigation of formaldehyde gas levels in houses in St. John's, Newfoundland.** Georghiou, P.E.; Snow, D. (Health and Welfare Canada, Ottawa, Ontario). 1982. 37p. (In French). (MICROLOG—83-3101; CE—02179). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The analytical method used in most determinations of indoor formaldehyde levels up to now has been the Method P&CAM 125, recommended by the National Institute for Occupational Safety and Health (NIOSH). The method is sensitive enough but it is complex and a high degree of skill is required in its use. It was proposed to investigate the feasibility of using alternative methods which require less expertise. In a field study the use of a portable single-beam infrared spectrophotometer, the Miran 1A General Purpose Gas Analyzer, was evaluated and formaldehyde levels measured with this instrument were correlated with levels measured simultaneously by the NIOSH method. The instrumental method was evaluated by examining a group of homes in the St.John's area. In addition, a limited survey of relevant study home characteristics was conducted. It was found that no acceptable correlation existed between the NOISH-and MIRAN-determined levels. The levels of formaldehyde observed in most cases were below the limits of sensitivity and precision possible with the MIRAN and furthermore, the infrared method was also found to be susceptible to unidentified interferants. The study was therefore broadened to include a limited field evaluation of another on-site analyzer, the CEA 555, and the prototype of a passive formaldehyde dosimeter; other applications for the Miran were also established. The CEA was found to offer some advantages in that it is more sensitive than the Miran. Passive dosimeters were seen to offer a more meaningful time-weighted average of formaldehyde exposure levels. 11 refs., 2 figs., 5 tabs..

19727 **(IEC—8010) Energy audit and design project for the Lasqueti Island Elementary School.** (Ideal Energy Consultants, Lasqueti Island, British Columbia (Canada)). 1980. 65p. (CE—02337). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report is a detailed examination of energy conservation measures and renewable energy technology appropriate to be used at a school on an island in British Columbia. An energy audit was conducted to examine the current state of the building systems, and this report describes the present situation, recommended changes, and estimated costs with respect to insulation, windows, thermostats, airtightness, ventilation, water heating, power generation, and solar gains. Proposed improvements are outlined in the areas of energy conservation (additional insulation, double glazing, modified thermostat operation and so on), increasing efficiency of the diesel generating system (including use of waste heat to heat the building floor), and renewable energy sources. The latter possibilities include solar heating and wind power. Economic analysis for the various options is presented and it is shown that average fuel expenditure would be reduced from about $9,500/y to $2,800-4,220/y if all the systems described in the report (except the windmill) are implemented. This implies a 71% to 56% reduction, and a payback period of 6.65 to 8.45 years, depending on weather and staff conservation habits. 3 figs., 3 tabs.

19728 **(INIS-GB—181) Energy assessment for dwellings using BREDEM workshops.** Anderson, B.R. (Building Research Establishment Scottish Lab., East Kilbride (UK)). Nov 1988. 6p. (BRE-IP—13/88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757116/JAW.

The information presented provides the data needed for a 'worksheet' calculation of energy use in dwellings, based on the BREDEM method. The worksheet illustrates the methodology in a form that is simple to use. For convenience in carrying out several calculations the worksheet has been implemented for use on a hand-held calculator and on IBM-compatible microcomputers. The information is addressed to building services engineers,, architects, builders, suppliers, housing authorities, home-owners and any other concerned with improving energy efficiency in residential buildings.

19729 **(INIS-GB—182) Average daylight factor: a simple basis for daylight design.** Littlefair, P.J. (Building Research Establishment, Watford (UK)). Nov 1988. 4p. (BRE-IP—15/88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757117/JAW.

Good design of windows should include planning for daylight at the early design stage. Average daylight factor is especially suitable for this purpose as it can be used in the direct calculation of target glazing areas. The use of formulae developed at BRE to enable average daylight factor to be calculated quickly and accurately is described. It will be of interest to architects and engineers involved in window design.

19730 **(KTH-IB-AR—1987-1) Study of energy conservation measures in older residcntial buildings with regard to construction, installation and operation techniques. Ulvsunda Project phase 2.** Waanggren, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Byggnadsteknik). Apr 1987. 188p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88757048/JAW.

The Ulvsunda Project is one of the earliest energy conservation projects in existing buildings also from a worldwide point of view. As object for the study were chosen slab block apartment buildings, a large and homogeneous type of buildings, now in turn for restoration. The results are presented under the following headings; * Description of buildings and energy conservation measures within phase 1. * Ulvsunda Project Phase 2. * Measuring methods and equipment. * Additional insulation of outer walls. * Comfort insulation of floors above basements. * Conversion of existing double-glazed windows into treble-glazed windows. * Heat recovery from exhaust air. * Water saving measures. * Production systems for heat and tap water. * Heat distribution system. * Evaluation of energy conservation. * Costs and savings. (O.S.).

19731 **(LBL—24873) Performance of electronic ballasts and other new lighting equipment: (Phase 2, The 34-watt F40 rapid start T-12 fluorescent lamp): Final report.** Verderber, R.R.; Morse, O. (Lawrence Berkeley Lab., CA (USA)). Feb 1988. Contract AC03-76SF00098. 58p. NTIS, PC A04 - OSTI. Order Number DE89008840/JAW.

This study has measured the performance of energy-saving 34-watt F40, T-12, rapid-start, lite white fluorescent lamps being operated by solid-state ballasts and lighting control equipment. The

performances of these lamp systems are compared with those of 40-watt F40, T-12 rapid-start cool white fluorescent lamp systems studied in the prior phase of this project. With the 34-watt F40 lamps and various solid-state ballasts, system efficacy ranged from 67 to 84 lumens per watt and ballast factor from 0.756 to 0.908. Average system efficacy using the 34-watt lamps exceeded that of systems using 40-watt lamps and the same solid-state ballasts by only 1 percent even though the 34-watt lamps is about 6 percent more efficacious than the 40-watt lamp. This apparent discrepancy is due to increased ballast losses when operating the 34-watt lamps. However, the systems efficacy of the 34-watt lamps used with a solid-state ballast exceeded that of a 34-watt, two-lamp system using the standard core-coil ballast by as much as 29 percent. A T-8 fluorescent lamp system with a smaller lamp diameter was also included in the study. Operating this lamp with a solid-state ballast produced a high system efficacy of 90 lumens per watt, a 39 percent improvement over the efficacy of a 40-watt F40 system using the standard core-coil ballast. The use of static controllers with 34-watt F40 lamps can result in excessive flickering (46 percent) and the generation of a second harmonic as high as 96 percent of the fundamental frequency. The dynamic controllers, when used to dim the 34-watt lamps generally cannot be dimmed as low as the 40-watt lamp system without flickering. In general, the 34-watt energy-saving lamps are appropriate as a retrofit to reduce illumination levels. However, for new construction, the 40-watt F40 argon filled lamps cost less, perform better, and provide a more reliable system. 5 refs., 27 figs., 9 tabs.

19732 **(LBL—25785) The elasticity of appliance demand for energy with respect to efficiency.** Stoft, S. (Lawrence Berkeley Lab., CA (USA)). Jan 1988. Contract AC03-76SF00098. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008855/JAW.

This paper presents a practical method for estimating the elasticity of demand for energy with respect to a change in appliance efficiency. The first step in this direction was taken by J. Daniel Khazzoom (1980), who challenged the idea that mandating more efficient appliances would lead to a decline in energy demand. To do so he criticized those who ignored the consequences of reduced service cost and who took account only of the mechanical effects of efficiency improvements. Henly et al. (1987) have taken the next step and corrected Khazzoom's equation to make it account for the cost of owning and operating the appliance. This paper derives an approximation to Henly's equation that is practical in much the same way that Khazzoom's equation is practical. That is, the new equation shifts the information requirements from a knowledge of the consumer's response to a complex change in appliance prices to a knowledge of the consumer's response to a change in energy price coupled with the consumer's discount rate. After presenting the new approximation, a simple example is used to demonstrate that the new effects captured by it could be large enough to reverse Khazzoom's "rebound" effect. Thus any serious estimation of the elasticity of energy demand with respect to efficiency must rely on the new equation. 5 refs., 2 tabs.

19733 **(LBL—26152) An evaluation of energy conservation programs for new residential buildings.** Vine, E.; Harris, J. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 25p. (CONF-8810303—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006651/JAW.

From American Evaluation Association annual meeting; New Orleans, LA, USA (27 Oct 1988).

This paper evaluates the implementation of programs promoting energy efficiency in new residential construction. This paper is one of a series of program experience papers that seeks to synthesize current information from both published and unpublished sources to help utilities, state regulatory commissions, and others to identify, design, manage, and evaluate demand-side programs. We focused our investigation on nonmandatory programs that are designed to complement--or in some cases substitute for--mandatory energy requirements in local and state building codes. We evaluated the following types of nonmandatory programs: technology demonstrations, pilot demonstration programs, financial incentive programs (including rebates, conservation rates, reduced hookup fees, reduced loan interest rates and loan-qualifying criteria, guaranteed savings, and tax credits), consumer information and marketing programs (including energy ratings systems and energy awards), technical information programs (including professional guidelines, design tools, design assistance, and standards-related training, compliance, and quality control), and site and community planning. 9 refs., 2 tabs.

19734 **(LBL—26343) High-LET alpha-emitters: Radon, lung cancer and smoking.** Fabrikant, J.I. (Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098. 13p. (CONF-8810306—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006661/JAW.

From Workshop on recent advances in biological sciences, low dose and low dose rate ionizing radiation; San Diego, CA, USA (18 Oct 1988).

The National Academy of Sciences BEIR IV Report deals with the health effects in human populations exposed to internally-deposited alpha-emitting radionuclides and their decay products. Quantitative risk estimates for cancer induction are derived, mainly from analyses of epidemiological data. The Report addresses the health outcomes of exposure to radon and its daughters, primarily lung cancer risks of worker exposure to radon progeny in underground mines and in the general public in indoor domestic environments. An excess relative risk model of lung cancer mortality and exposure to radon progeny is developed; this models the excess risk per Working Level Month in terms of time intervals prior to an attained age, and is dependent on time-since-exposure and age at risk. Risk projections are presented and cover exposure situations of current public health concern. For example, lifetime exposure to 1 WLM y/sup {minus}1/ is estimated to increase the number of deaths due to lung cancer by a factor of about 1.5 over the current rate for both males and females in a population having the current prevalence of cigarette-smoking. Occupational exposure to 4 WLM y/sup {minus}1/ from ages 20 y to 40 y is projected to increase lung cancer deaths by a factor of 1.6 over the current rate of this age cohort in the general population. In all of these cases, most of the increased risk occurs to smokers for whom the risk is up to ten times greater than for non-smokers. 8 refs., 1 tab.

19735 **(OAEC—8803) Agricultural ventilating and heating controls.** MacDonald, R.D.; Fraser, H.M. (Ontario Agriculture Energy Centre, Guelph (Canada)). 1988. 4p. (CE—02309). Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, Ont., Canada N1H 6N1; $N/C.

This report outlines the kinds of new and improved controls for heating and ventilation systems in agricultural buildings, especially livestock and poultry barns. Temperature controls include electronic variable-speed controls for fans and heaters, using remote electronic sensors; single-unit sequential controls that control all levels of heating and ventilating; and microcomputers used to control heating, ventilation and air inlet equipment. Other kinds of controls, more briefly described, are light dimmer switches and manual variable-speed motor controls. 6 figs., 1 tab.

19736 **(OAEC—8806) Insulation for farm buildings.** Huffman, H. (Ontario Agriculture Energy Centre, Guelph (Canada)). 1987. 4p. (CE—02311). Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C.

Insulation for agricultural buildings is reviewed in this report. It is used to reduce heat losses in winter (or heat gain in summer) and to reduce condensation. In the case of livestock buildings, the latter point is a greater potential problem than in the case of houses because of the higher humidity. Types of insulating materials are outlined, including loose fill, fibrous blanket, rigid fibrous, and rigid plastic foam. Recommendations are made on how to evaluate the suitability of a particular type of insulation and the quantity of insulation that should be used. The importance of vapor barriers in solving the condensation problem is also summarized. Guidelines for construction of foundations to prevent damage to insulation by rodents are also presented. 4 figs., 1 tab.

19737 **(ORNL/CON—264) Energy savings in new, low-rise multifamily buildings: Model conservation standards in Tacoma, Washington.** Tonn, B.E.; White, D.L.; Currier, C. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007923/JAW.

This report analyzes savings in the multifamily sector attributable to the MCS code. Multifamily buildings constructed in different years in Tacoma comprise our MCS and control samples. For the multifamily sector in weather zone 1, in which Tacoma is located, the NPPC estimated that apartment units in buildings built to MCS would consume 1.2 kWh/ft²/year for space heating electricity versus the estimated 3.4 kWh/ft²/year consumed by units in buildings built to current practice. The NPPC estimated that the MCS code would cut space heating requirements by 65% per square foot per unit in the multifamily sector. This estimate greatly exceeds savings to date attributable to conventional weatherization programs in this sector. This document reports that MCS savings of approximately 15% to 25%, which fall in between the NPPC estimates for construction of energy efficient new buildings and those of other programs. This paper discusses the data and general research methodologies used in this work. The buildings, units and occupants are profiled, and space heating savings estimates based on models of individual units and buildings are presented. A great deal of attention is directed to handling modeling problems caused by changing occupancy and vacancies in the sample buildings. 31 refs., 3 figs., 22 tabs.

19738 **(ORNL/CON—276) Recent publications of DOE's Office of Buildings and Community Systems.** Brown, M.A.; Hayes, J. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 89p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007860/JAW.

This bibliography lists recent publications describing the results of the R&D program of the US Department of Energy's Office of Buildings and Community Systems. It includes reports, articles, book chapters, monographs, and other documents published between 1985 and the present. More than 900 citations are listed. Major categories include: new buildings; existing buildings; building energy analysis and monitoring; space conditioning equipment; lighting; appliances; building structures; integration of buildings; community energy supplies and services; and technology transfer. Both an author and subject index are included.

19739 **(ORNL/M—529) A new technology transfer process for DOE's residential and commercial conservation program.** Brown, M.A.; White, D.L.; Vories, R.; Kirchen, S. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 89p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007928/JAW.

This report provides a technology transfer plan for DOE's Residential and Commercial Conservation Program (RCCP). It catalogues and classifies the types of research results and lessons developed and disseminated by the Program, and examines the audiences for these results. It then describes the process of assessing needs, analyzing potential technology transfer mechanisms, and evaluating progress that should be part of the technology transfer process for RCCP and its individual projects. A technology transfer strategy is proposed along with recommended future technology transfer activities. A set of seven worksheets is also developed to help RCCP program managers design outreach efforts for their current and future projects. 28 refs., 12 figs.

19740 **(ORNL/M—728) Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer progress report for DOE office of buildings and community systems: Monthly progress report, January 1989.** Coleman, G.L.; Samples, S.D. (comps.). (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007913/JAW.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evolution over a period of several months.

19741 **(ORNL/Sub—84-21006/3) Structural thermal break systems for buildings: Heat transfer characteristics of lightweight structural concrete walls: Final report.** Van Geem, M.G. (Oak Ridge National Lab., TN (USA); Construction Technology Labs., Skokie, IL (USA)). Dec 1988. Contract AC05-84OR21400. 143p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007910/JAW.

A lightweight structural concrete was developed for use in exterior walls of low-rise residential and commercial buildings. The lightweight concrete has a unit weight of 50 pcf (800 kg/m³), a compressive strength of 2000 psi (13.8 MPa) and a thermal conductivity of 1.6 Btu{center←dot}in./hr{center←dot}ft² {center←dot}{degree}F (0.23 W/m{center←dot}K). Lightweight concretes have not been previously developed with this combination of low density and moderate compressive strength. The portland cement concrete developed for this project can be used to combine structural, thermal insulation, and heat storage capacity functions of exterior walls in one element. For many climates this concrete can be used without additional insulation as a complete wall system in low-rise buildings. 23 refs., 54 figs., 19 tabs.

19742 **(ORNL/Sub—85-27486/1) A capacitance probe for measurement of moisture content in open pore thermal insulations.** Motakef, S.; Glicksman, L.R. (Oak Ridge National Lab., TN (USA); Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Jan 1989. Contract AC05-84OR21400. 132p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007909/JAW.

Low slope roofs often experience deterioration by moisture condensation and water seepage within the built-up structure. Instrumentation to date for measuring the amount of moisture in roofing has had limited success and has centered on large aerial surveys. This paper documents the design of instrumentation to measure the moisture content by volume of porous building materials. The final configuration includes a fork-like 24 pin capacitance probe and an electronic circuit which outputs a voltage corresponding to the wetness measured. The probe is intrusive yet nondestructive, and gives localized readings which are good for grid surveys. An accompanying electronic circuit allows for real-time capacitance readings with dc voltage output. This instrumentation has been calibrated for board and ceiling fiberglass as well as phenolic insulations. Insertion methods place the probe as deep as six inches into fiberglass with minimal disturbance to the material. Tests within a small-scale roof testing apparatus have shown that moisture movement can be quantitatively followed successfully. The uncertainty of moisture determination is 10%. The method is accurate within the moisture content range of 0 to 30% for fiberglass while a wider, yet undetermined, range exists for phenolic. 17 refs., 33 figs., 1 tab.

19743 **(ORNL/TM—10339) Changes in the heating and cooling energy use in buildings due to lowering the surface solar absorptance of roofs.** Griggs, E.I.; Courville, G.E. (Oak Ridge National Lab., TN (USA); Tennessee Technological Univ., Cookeville (USA)). Feb 1989. Contract AC05-84OR21400. 102p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007917/JAW.

This report addresses how changing a flat roof's solar absorptance alters the energy required to heat and cool a building. The increase in a roof's surface temperature due to insolation increases the building's heat gain during the summer and reduces its heat loss during the winter. This study examines this counteracting influence on annual HVAC energy use. The report reviews pertinent background and presents computed changes in heating and cooling needs obtained using the computer code, DOE 2.1B. All computations were made corresponding to a reduction in a flat roof's solar absorptance from 0.8 to 0.3. They were made for two different buildings using TMY weather data for twenty cities within the United States; they were also made for a third building using weather data for five US cities. Computed annual changes in building heating and cooling energy use are presented in the form of bar

charts for each location. Calculations were made for three different roof insulation levels. The change in annual energy use caused by the reduction in solar absorptance decreases with increased roof insulation. This effect is depicted graphically for representative cases. Incorporating realistic HVAC system performance and using a particular energy cost scenario based on use of natural gas for heating and cooling via an electrically driven unit, the best cost savings occurred for locations in the Southwest and were equivalent to approximately the costs of 1 Kw-hr of electrical energy per square foot of flat roof surface. 16 refs., 18 figs., 29 tabs.

19744 **(PNL—6255) Advanced energy design and operation technologies research: Recommendations for a US Department of Energy multiyear program plan.** Brambley, M.R.; Crawley, D.B.; Hostetler, D.D.; Stratton, R.C.; Addision, M.S.; Deringer, J.J.; Hall, J.D.; Selkowitz, S.E. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 195p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008655/JAW.

This document describes recommendations for a multiyear plan developed for the US Department of Energy (DOE) as part of the Advanced Energy Design and Operation Technologies (AEDOT) project. The plan is an outgrowth of earlier planning activities conducted for DOE as part of design process research under the Building System Integration Program (BSIP). The proposed research will produce intelligent computer-based design and operation technologies for commercial buildings. In this document, the concept is explained, the need for these new computer-based environments is discussed, the benefits are described, and a plan for developing the AEDOT technologies is presented for the 9-year period beginning FY 1989. 45 refs., 37 figs., 9 tabs.

19745 **(PNL—6751) Initial findings: The integration of water loop heat pump and building structural thermal storage systems.** Marseille, T.J.; Johnson, B.K.; Wallin, R.P.; Chiu, S.A.; Crawley, D.B. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 138p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008654/JAW.

This report is one in a series of reports describing research activities in support of the US Department of Energy (DOE) Commercial Building System Integration Research Program. The goal of the program is to develop the scientific and technical basis for improving integrated decision-making during design and construction. Improved decision-making could significantly reduce buildings' energy use by the year 2010. The objectives of the Commercial Building System Integration Research Program are: to identify and quantify the most significant energy-related interactions among building subsystems; to develop the scientific and technical basis for improving energy related interactions in building subsystems; and to provide guidance to designers, owners, and builders for improving the integration of building subsystems for energy efficiency. The lead laboratory for this program is the Pacific Northwest Laboratory. A wide variety of expertise and resources from industry, academia, other government entities, and other DOE laboratories are used in planning, reviewing and conducting research activities. Cooperative and complementary research, development, and technology transfer activities with other interested organizations are actively pursued. In this report, the interactions of a water loop heat pump system and building structural mass and their effect on whole-building energy performance is analyzed. 10 refs., 54 figs., 1 tab.

19746 **(PNL-SA—16541) ATES/heat pump simulations performed with ATESSS code.** Vail, L.W. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 18p. (CONF-890179—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007241/JAW.

From 3. workshop on solar assisted heat pump with ground coupled storage; Gothenburg, Sweden (16 Jan 1989).

Modifications to the Aquifer Thermal Energy Storage System Simulator (ATESSS) allow simulation of aquifer thermal energy storage (ATES)/heat pump systems. The heat pump algorithm requires a coefficient of performance (COP) relationship of the form: COP = COP/sub base/ + α(T/sub ref/ {minus} T/sub base/). Initial applications of the modified ATES code to synthetic building load data for two sizes of buildings in two US cities showed insignificant performance advantage of a series ATES heat pump system over a conventional groundwater heat pump system. The addition of algorithms for a cooling tower and solar array improved performance slightly. Small values of α in the COP relationship are the principal reason for the limited improvement in system performance. Future studies at Pacific Northwest Laboratory (PNL) are planned to investigate methods to increase system performance using alternative system configurations and operations scenarios. 2 refs., 3 figs., 5 tabs.

19747 **(SC—8503) The thermal and flow performance of furnace flues in houses. Vol.1, summary report.** Swinton, M.C.; Monette, M.D.; Haysom, J.C.; Platts, R.E. (Scanda Consultants Ltd., Ottawa, ON (Canada)). 1985. 34p. (CE—02374). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The phenomena of chimney backdrafting, and the performance of furnaces and flues under conditions that lead to backdrafting, were investigated in an analytical and modelling study of the problem. The study consisted of a literature review, interviews with scientific authorities, the development of a modelling framework, implementation and parameterization of that framework on a microcomputer, test simulations, preliminary model validation and sensitivity analyses. The sensitivity analysis highlighted the fact that presently accepted heating technologies used in low energy buildings (e.g. atmospheric combustion systems) can be incompatible with the levels of house depressurization that can result from combinations of high levels of envelope airtightness and common exhaust fan and fireplace flows. This incompatibility can result in spillage and backdraft of combustion products into the house. Even in leaky houses, the model predicts that the house may be a more efficient chimney than a poorly-insulated chimney on an outside wall. After long off-cycles, therefore, the combustion device may have to establish chimney flow against a stable backdraft condition. The model awaits more detailed validation based on detailed field testing of combustion appliances in houses. It can also be amplified to properly model several other phenomena such as mixed flows in flue pipes, the operation of wood stoves and of fireplaces, passive ventilation ducts and multiple appliances on the same flue. 3 figs., 1 tab.

19748 **(SFU—8305) Evaluation of the Energy Cost Indicator demonstration program: a report on Canadian and US field experiments.** Hutton, R.B.; Mauser, G.A.; Filiatrault, P. (Simon Fraser Univ., Burnaby, British Columbia (Canada); Quebec Univ., Montreal (Canada); Denver Univ., CO (USA)). 1983. 105p. (CE—02386). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents the results of four field experiments, 2 in Canada and 2 in the USA, to test the effectiveness of a new product designed to encourage energy conservation--the Energy Cost Indicator (ECI), which measures total household usage of electricity and gas and presents the data in a number of energy cost-vs-hours of use formats. Sample households received the ECI and were compared with control groups. Research objectives were to measure changes induced by the ECI on various energy consuming behaviors, including gas and electricity consumption, awareness of energy related factors in the household, and attitudes toward energy conserving products. In the Canadian experiments, a significant decrease in total energy consumption was noted in households using the ECI, but the US experiments showed no significant differences. In all experiments, attitudes toward the ECI were found to be positive. 3 figs., 40 tabs.

19749 **(SP-RAPP—1987-33) Measuring of overall building conduction heat loss coefficient.** Lundin, L. (Statens Provningsanstalt, Boraes (Sweden)). 1987. 28p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757072/JAW.

Several ways of measuring the k-value of a building have been presented through the years. All of these have been based on the measuring of one or more points in a construction. Since the heatflow through a building construction is not evenly spread, several measuring results have to be obtained to receive a mean value. The method presented in this report is based on the much simpler principle that the amount of used energy is equal to the amount added. The theory is obviously very simple. The reality, however, provides some practical problems. The report describes how to measure the k-value in a building construction without being bothered by thermal bridges and air leakage. To illustrate this principle, measurements from three different types of constructions are described. The project has been carried out in connection with a Nordtest-method according to the same principle.

19750 **(SRC/ECR—R-823-3-E-84) Evaluation of CMHC-2. Vol. 1.** Sulatisky, M. (Saskatchewan Research Council, Saskatoon (Canada). Energy Conservation Program). 1985. 78p. (CE—02375). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The CMHC-2 computer program was developed to assist in both energy and financial analysis of lowrise housing, and to help evaluate energy conserving measures in such buildings. An investigation was undertaken to evaluate the effectiveness of CMHC-2 in meeting the needs of a variety of users who have an interest in improving the thermal performance of housing units. A survey of housing industry representatives indicated ca 50% would purchase CMHC-2. Builders comprise the largest user group, followed by architectural and engineering firms, educational institutions, building product manufacturers, government agencies, and utilities. Limitations were noted in the areas of program documentation and instruction manuals, the base data provided, the difficulty in accessing data, the lack of recommendations for existing structures (retrofits), and the limited amount of validation available. It was stated that the program is one of the most sophisticated ones developed for lowrise housing, and the participants each recognized one or more applications in which they had a primary interest. CMHC-2 was seen as compatible with public sector initiatives undertaken in the future, and further, could be a successful tool to enhance their implementation. The report concludes that there is a need for a program like CMHC-2, but it requires further refinements and additional features prior to release. It was recommended that a private company be made responsible for promotion and distribution. 8 tabs.

19751 (STU—85-5404, pp 73-78) **Corrosion testing of secondary coolants for heat pump systems.** Berendson, J. (Royal Inst. of Tech., Stockholm (SE). Dept. of Applied Electrochemistry and Corrosion Science). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

In this investigation the interest was focused on the corrosivity of secondary coolants based on calcium chloride, ethanol or potassium carbonate. Ethylene glycol was used as a reference solution. Both laboratory and plant tests were performed by using coupons of some common metals immersed in these solutions Evaluation of the coupon-tests was made by visual inspection and weight loss measurements. The results indicated a remaining risk for localized corrosion on carbon steel in brines based on calcium chloride. The general corrosion rate of carbon steel was relatively high in an aqueous solution containing 25% ethanol, because of the fact that the original corrosion inhibitor was excluded from the commercial product as one of the constituents caused foaming in the system. The most promising alternative seemed to be a solution based on potassium carbonate with addition of corrosion inhibitors. In a plant test lasting for a period of one year, the general corrosion rate was determined to be less than 1 mdd (mg/dm/sup 2/ and day) for carbon steel and for grey cast iron. The corrosion rates were also quite negligible for other metals exposed for inhibited potassium carbonate in pilot plant tests.

19752 (STU—85-5404, pp 113-116) **Electrochemical cell detecting the internal corrosion in district heating systems.** Berggreen Petersen, M.; Jansen, P. (Korrosionscentralen, Broendby (DK)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Results from the development of an electrochemical cell to examine the propagation of localized corrosion in circulating heating water is described. The cell is based on the formation of an oxygen concentration element. The essential feature of the method is that it reflects the influence of oxygen content, conductivity and temperature on localized corrosion. Corrosion rates measured with the cell are consistent with the corrosion rate found in radiators in heating systems where the water quality is poor. (authors).

19753 **(STU—86-3553) Evaporation heat pumps and refrigeration machines.** Ljung, L. (3K Engineering, Stockholm (SE)). (Swedish National Board for Technical Development, Stockholm). Jan 1987. 32p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757087/JAW.

This study concerns feasible improvements of heat pumps and refrigeration machines based upon the evaporation process. Improvements here mainly refer to higher thermal/refrigerant coefficients. Some thermodynamic improvements are discussed such as: Reduction of 'heat respiration' losses for compressors. Use of nonazeotropic compounds as working media. Different methods to utilize exergy content of the expanding condensate concerning expansion valves. Different methods for continuous regulation of capacity. Feasibility of utilizing the heating pipe principle as an energy source. Methods to influence frost formation upon cold surfaces are also discussed. Tests with surfactant substances have been performed, unfortunately with negative results. Environmental aspects of freons used in evaporation processes are discussed. A study aiming to find environmentally more suitable media is proposed. (L.F.).

19754 **(SV-UL—88-7) Field test of direct expansion ground-source heat pumps for heating and cooling applications in single family houses.** Spante, L.; Larsson, M.; Oesterberg, R.; Lenarduzzi, F.; Young, D.J.; Bell, J.M. (Swedish State Power Board, Vaellingby; SwedPower, Stockholm (SE); Ontario Hydro Research Division, Toronto (CA)). (Swedish State Power Board, Vaellingby). 20 Sep 1988. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757098/JAW.

Ontario Hydro Canada, Swedish State Power Board and SwedPower Sweden have decided jointly to test a heat pump application with direct evaporation in vertical bore holes. The heat pumps under test are designed for both heating and cooling and are applicable to single family homes. The co-operative project was started 1987. Two heat pumps were installed in Sweden and one in Canada in single family homes. A detailed monitoring program is applied to the test sites. The heat pump refrigerant circuit is connected to copper pipes inserted in the bore hole. The refrigerant evaporates inside the pipes during operation in heating mode and condenses in the pipes in cooling mode. There are two separate coils in the bore hole, one coil for cooling and one for heating. The project is still in an early phase but preliminary results from part of the first heating season show satisfactory performance in heating mode. Results from the first cooling season during the summer 1988 have not yet been thoroughly analysed but indicate that more experience and research work is necessary in order to get an optimal design of the refrigerant system for the case with air conditioning. (authors).

19755 **(TNO-HMT—86-026) Energy consumption in minimum energy dwellings.** Van Bergen, F.M.; Schuringa, W. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Jan 1986. 32p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

In a practical experiment in Schiedam, Netherlands, 76 single family dwellings for a minimal energy consumption have been built. Part of the experiment was pratical testing of design hypotheses. One important hypothesis was the predicted annual gas consumption for heating at an average heating behavior. The gas consumption was estimated by means of a calculation model at 300 m/sup 3/ natural gas for a south-oriented intermediate dwelling. Based on measurements in unoccupied houses this hypothesis has been adjusted for an average consumption of 390 m/sup 3/ natural gas for all directions. In occupied dwellings the average consumption appeared to be 425 m/sup 3/ natural gas. The causes of this slightly higher consumption are probably a higher quantity of ventilation air by opening the windows and a for the purpose of this project specially developed integrated heat generation installation for supplementary heating and for water heating. 4 figs., 13 tabs.

19756 **(TNO-HMT—86-384-Dl.1) Research on the energetic effect of thermal insulation of the intermediate floor and a passage as part of the wind-heat project in Huizen, Netherlands. Part 1.** Dubbeld, M.; Schiphouwer, H.; Van Dongen, J.E. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Dec 1986. 85p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

The research on the subject as stated in the title aims at determining the usefulness of thermal insulation of the floor between the groundfloor and the second floor of single family dwellings and the application of a covered passage with regard to the energy consumption. The effect of these measures has been determined for four different types of installations: air heating, local heating, central radiant heating with individual heat generation 90/70 and central radiant heating with collective heat generation 60/46. The investigation is subdivided into measurements carried out in the dwellings, a survey of inhabitants behavior and model calculations by means of the so-called multi-room model. The appendices appear in part 2 for which a separate abstract has been prepared. 23 figs., 7 refs., 55 tabs.

19757 **(TNO-HMT—86-384-Dl.2) Research on the energetic effect of thermal insulation of the floor and a passage as part of the wind-heat project in Huizen, Netherlands. Part 2: Appendices.** Dubbeld, M.; Schiphouwer, H.; Van Dongen, J.E. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Dec 1986. 89p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

The research on the subject as stated in the title aims at determining the usefulness of thermal insulation of the floor between the groundfloor and the second floor of single family dwellings and the application of a covered passage with regard to the energy consumption. The effect of these measures has been determined for four different types of installations: air heating, local heating, central radiant heating with individual heat generation 90/70 and central radiant heating with collective heat generation 60/46. The investigation is subdivided into measurements carried out in the dwellings, a survey of inhabitants behavior and model calculations by means of the so-called multi-room model. The measuring methods and the main results appear in part 1 for wich a separate abstract has been prepared.

19758 **(TNO-HMT—87-041) Cost price reduction of vertical heat exchangers.** Wormgoor, J.W. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Jan 1987. 30p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

An important aspect of each heat pump installation is the choice of the heat source. For almost every installation there is the possibility to choose from different heat sources (open air, surface water, waste water flow, groundwater or the soil). The selection criteria can be the availability, the costs, the temperature level and nuisances. In this report attention is paid to characteristics and costs of one type of heat pump, the vertical ground heat exchanger. By means of such an exchanger a useful heat source can be realized from a technical viewpoint. It is questioned which developments are necessary to compete in financial respect. Aspects with regard to capacity and cost have been analyzed. Next to that a number of interviews with suppliers and installers of the concerning systems was held to determine the possibilities of reducing costs. 4 figs., 5 refs., 3 tabs., 3 apps.

19759 **(TNO-HMT—87-042-Dl.1) Causes and remedies of compressor damage in 'Heat Pump Netherlands'-projects. Part 1: Main report.** Van der Horst, J.F. (ed.). (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). May 1987. 60p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

In four heat pump projects, as part of the demonstration program 'Warmtepomp Nederland' (Heat Pump Netherlands), compressor damage occurred. This concerns damaged pistons and cylinder lining, broken drive rods and excessive wear of bearings. The damages occurred in projects in Apeldoorn, Maarssenbroek (2x), Rotterdam and Tilburg and concern Grasso AC-compressors. The purpose of this research is the determination of the causes of the damages and indicate in what way these damages can be prevented. The investigation includes visual and microscopic research on damaged compressor parts, calculations of strength and vibration with regard to the compressors, inventorize relevant characteristics of the heat pump installations and assessment of cooling technical diagrams and operating conditions. The appendices are presented in an other report for which a separate abstract has been prepared. 9 figs., 13 refs., 7 tabs.

19760 **(TNO-HMT—87-042-Dl.2) Causes and remedies of compressor damage in 'Heat Pump Netherlands'-projects. Part 2: Appendices.** Van der Horst, J.F. (ed.). (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). May 1987. 80p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

In four heat pump projects, as part of the demonstration program 'Warmtepomp Nederland' (Heat Pump Netherlands), compressor damage occurred. This concerns damaged pistons and cylinder lining, broken drive rods and excessive wear of bearings. The damages occurred in projects in Apeldoorn, Maarssenbroek (2x), Rotterdam and Tilburg and concern Grasso AC-compressors. The purpose of this research is the determination of the causes of the damages and indicate in what way these damages can be prevented. The investigation includes visual and microscopic research on damaged compressor parts, calculations of strength and vibration with regard to the compressors, inventorize relevant characteristics of the heat pump installations and assessment of cooling technical diagrams and operating conditions. The appendices are presented in this report. A separate abstract has been prepared for the main text which appears in another report.

19761 **(TNO-HMT-R—87/087) Climate in unheated bedrooms of the minimum energy houses in Schiedam, Netherlands.** Dubbeld, M.; Molenaar, J.; Van Schijndel, L.L.; Ham, P.J. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Mar 1987. 49p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 217, 2600 AE Delft, Netherlands.

The temperature and humidity of the bedrooms in four energy saving dwellings equipped with multi-burners for space heating are measured. The bedrooms have no separate heating. It is determinded if and how the acquired bedroom temperature is reached. The inhabitants reach the acquired bedroom temperature by closing the shutters at night and internal circulation of hot air between living room and bedroom. It is indicated how one heater can heat the bedrooms even without air transport from living room to the bedrooms. It is also indicated how the transport of cooking smells can be improved. 11 figs., 5 refs., 1 tab., 3 apps.

19762 **(TNO-HMT-R—87/275) Investigation of brownish discoloration in dwellings. Phase 1: Inventory and orienting research.** Cornelissen, H.J.; Steenlage, R. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Oct 1987. 53p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 217, 2600 AB Delft, Netherlands.

In a number of dwellings in the Netherlands a brownish discoloration of the interior (ceiling, wall paper, furniture) occurs mainly in the living room and in the kitchen. By order of the Dutch Energy Development Company (NEOM) the section Inner Climate of the Division of Technology for Society, TNO, Netherlands, this discoloration was investigated. The investigation is aimed at finding out the causes of the discoloration and resolve the problem. This part of the investigation (phase 1) gives the results of an inquiry of 15 dwellings and an investigation of the neighbourhood. The airtightness, the mechanical air transport and the possibility of a flow back of flue gases was checked for a number of houses. Some dust samples were taken and analysed by means of different techniques. Phase 2 presents the results of long-term measurements. 3 figs., 7 refs., 11 tabs., 3 apps.

19763 **(TNO-TPD—615.047) Measuring project 'Energy experiment field'. Part 7: Heating season 1986-1987.** Hensen, J.L.; Braat-Eggen, P.E. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Sep 1987. 53p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

The 'Energy experiment field' is a practical experiment within the framework of research on the possibilities to lower energy consumption in the building construction sector. This part of the research is aimed at bringing the available measured data of the dwelling types Kristinsson and Van Ringen to the same level as of the other types in the project. First the measuring method is described. Then the most important results with regard to the energy consumption in the heating season 1986-1987 are presented. Subsequently the enquiry of inhabitants with regard to appreciation of the dwellings is dealt with. Finally a summary and conclusions are given. An outline of the dwelling concepts is presented in Appendix 1. 20 figs., 16 refs., 31 tabs., 4 apps.

19764 **(TNO-TPD—615.048) Final evaluation 'Energy Experiment Field'.** Hensen, J.L.; Hoen, P.J.; Van Luxemburg, L.C. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Jul 1987. 97p. (In Dutch). Technisch Physische Dienst TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

As part of the Dutch national research program on rational use of energy in the built environment (REGO) a real scale experiment with low energy single family houses was carried out. The project includes 56 low energy houses in Hoofddorp with an expected mean annual space heating demand of about 500 m/sup 3/ natural gas. The main purpose of this experiment was to determine in practice the relation and interaction between energy saving measures related to the construction, the systems and the architecture. The aim is that the 'Energieproeftuin' can be an example of the possibilities by the end of the eighties in the field of energy efficient single family housing. This is also the reason why almost all current construction techniques, in the Netherlands, are represented: traditional brickwork, prefabricated elements, cast and light weight concrete and wood frame. The different designs were evaluated by computations regarding energy consumption and thermal comfort. To be able to explain possible differences between predicted and actual energy consumption and indoor climate a measurement program was carried out to verify the assumptions concerning building, systems, occupants and occupancy aspects. Furthermore it is important to know whether the occupants appreciate the different house types and whether the technical solutions are easy to handle. The measurement program started during the building phase (1984) and was finished in 1987. The results of the different sub-programs are summarized and evaluated. Because of the large diversity in construction types, systems and energy saving measures a direct comparison of the different houses is not possible. 30 figs., 10 refs., 37 tabs., 1 app.

19765 **(VTT-TIED—877) Economy of planning of single family houses in the housing of Fair Tornio.** Hekkanen, M.; Kestilae, T. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jul 1988. 78p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757109/JAW.

The economy of a small house depends on many things. One of the most interesting is how the quality of internal walls, roofs and floors and furniture, fittings and equipment affect the building costs. The other thing which has a still more larger significance is the design plan of the house. The factor that describes this is /sup s/tructural quality/sup ./ It includes foundations, intermediate floors, facades and structures complementing framework. /sup T/he structural quality/sup /of a small house explains about 50% of the total building costs. The material of this study includes 17 small houses of the Housing Fair that was hold in Tornio in 1987. The houses were compared with the /sup n/ormal/sup /small house. A /sup n/ormal/sup /small house represents the accurance level of Finnish small house building. Generally, the houses of the study were about 25% more expensive than the normal level. The width of the house had no significance for the relative costs. The design plans were not very economical. That was due to big storage outside the house, complicated plannings (plenty of corners) and the great amount of windows, doors and walls. The details of structures were usual. The quality level of surfacings and coverings and furniture, fittings and equipment was high. The average overrun of building cost was 320 FIM/m/sup 2/ (cost level 6/1987), but in extreme case the overrun was 675 FIM/m/sup 2/. There was only one Swedish house that was cheaper than the normal level. The most important factors for cost overrunning were expensive materials of surfaces and coverings, big relative amounts of furniture and big relative amounts of equipment. The study showed that during the years 1979 and 1978 the plans of small houses have become more expensive, when one is looking at the Housing Fair buildings. However this can not be generalized for all small house production in Finland.

19766 **(VTT-TIED—923) Renewing of the form for profit and loss account amoung housing companies.** Marttila, M.; Lounela, T.; Pekkala, A.; Peltola, R.; Aeijaelae, S. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Rakennustalouden Lab.). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1989. 92p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757113/JAW.

The starting point of this study is an initiative of the council of the Building Maintenance Data in standardizing cost calculation of building maintenance and to modernize the grouping of the maintenance cost in the form for profit and loss account among housing and other real estate companies and adapt it to the principles of cost calculation. The reforming task of the form for real estate company became wider during the study and concerns now the whole structure of the form for profit and loss account. In reforming the form attention is paid specially to informativeness of profit and loss calculation and task orientation of grouping of maintenance cost. It is suggested that the structure of the form for profit and loss account should be reformed so that the part dealing with building maintenance is being separated from the part dealing with management of loans belonging to the stockholders of condominiums. Two alternatives are performed about grouping of building maintenance. In the first alternative the grouping of building maintenance follows the grouping in the patterns for building maintenance contracts, when labor costs of maintenance are divided into day-to-day use and maintenance, grounds' maintenance and cleaning according to the subcontracts in building maintenance. In the second alternative labor costs are divided according to classification of maintenance tasks in Building Maintenance Data in addition to the first also between heating, water and sewer, electrical services and waste management.

19767 **(VTT-TUTK—537) EBES-integrated HEVAC, piping, electrial and building system.** Korhonen, P.; Laine, J.; Muro, O.; Virtanen, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jun 1988. 90p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757114/JAW.

The heating, piping, ventilation and electrical systems and the structures in an open BES-element building system of apartment houses have been integrated into an energy economic overall EBES-system. With the aid of the developed installation and dimensioning methods, design instructions and new products, the water and sewage pipes and electrical installations can be placed in the hollows of the bearing floor and wall structures, which are also used for leading of the supply and exhaust air of ventilation. The exploitation of the building mass for storag of energy and as a part of the heating system is profitable when combined radiation and warm air heating is used. The supply air can be led into the room from the side wall outlet close to the external wall such that the supply air is blown in the direction of the external wall across the room. When preheated supply air (t>10 deg C) is led into the hollows of the hollow core slab in indoor air moisture does not condensate on the surface of the hollow core slab. The energy recovered from the heat transmission losses of hollow core slabs insulated on the outside is small and saving of energy marginal. The objective values imposed on the indoor climate of apartment houses meet the recommendations in the Compiled Finnish Building Regulations (D2:1987). The indoor air temperature can also be controlled to 21+-2 deg C, air change is 0.65-1.0 l/h and the highest allowed sound level is 25-30 dB(A). The functional prerequisities of a mechanical, sound attenuated supply and exhaust air ventillation system equipped with heat recovery in an EBES-apartment house are sufficient tightness of the ductwork (maximum leakage air flow rate 0.1 dm/sup 3//sm/sup 2/ at test presof 200 Pa), of the outer building envelope (n/sub 50/<0.5 l/h) and particularly of the floors (n/sub 50/<0.1 dm/sup 3//(sm/sup 2/)) and sufficient static pressure in the air ductwork (p/sub st/>100 Pa). (Abstract Truncated)

19768 **Energy design for architects.** Shaw, A. (ed.). Lilburn, GA; The Fairmont Press, Inc. (1989). 368p. The Fairmont Press, Inc., 700 Indian Trail, Lilburn, GA 30247. Order Number TI89006899/JAW. Contract AC06-76RL01830.

This book contains techniques for energy efficiency in architectural design. Many aspects are covered including: cost; comfort and health; energy use; the design process; and analytical techniques. 202 figs. (JF)

19769 **Gas particle radiator.** Chubb, D.L. (to Administrator of the National Aeronautics and Space Administration, Washington, DC). US Patent 4,770,232. 13 Sep 1988. Filed date 9 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a thermal absorbing and radiating apparatus adapted for use in the infrared spectrum and in a microgravity space environment, having a high specific power, long life time, high emissivity and low mass, comprising: a transparent boundary adapted for transmitting energy in the visible to the infrared spectrum and for protecting the apparatus from meteroid damage; a radiator spaced from the transparent boundary forming a plenum chamber therebetween; and a gas particle mixture dispersed and evenly distributed within the plenum chamber for facilitating thermal energy absorption and radiation and thereby enabling high emissivity of the apparatus to be achieved.

19770 **Gas heating system retrofits for low-income households: Evaluation results and future directions.** Berry, L.; Witte, P. (Energy Div., Oak Ridge National Lab., PO Box 2008, Oak Ridge, TN (US); Public Service Commission, Office of Planning, Policy and Evaluation, PO Box 30221, Lansin, MI (US)). *Energy Systems and Policy;* **12**: No. 2, 119-134(1988).

Evaluations were conducted of pilot programs, implemented in Kentucky, Minnesota, Michigan, and Pennsylvania, that were designed to encourage the inclusion of gas heating system retrofits in the Weatherization Assistance Program (WAP). All of the evaluations found that energy savings from the retrofits were less than anticipated and that the retrofits were not cost effective. The retrofits examined included heat extractors, power gas burners, electronic ignition and electric vent dampers, thermally actuated vent dampers, and tune-ups. The central conclusion is that gas heating system retrofits do not save much energy unless great care is taken in their application. Without extensive furnace selection procedures, along with careful training and quality control, technically possible reductions in consumption will not be achieved. If the inclusion of heating system retrofits in WAP is to be cost effective, better technical understanding and more highly individualized approaches to retrofit selection are required. In addition, the problem of developing organizational arrangements that can deliver highly individualized and technically demanding services must be solved. At present, the incorporation of furnace retrofits into WAP is not recommended. Furnace replacement is easier to implement and may be more cost effective.

19771 **Energy conservation for low-income households.** Schweitzer, M. (Oak Ridge National Lab., Energy Div., Oak Ridge, TN (US)). *Energy Systems and Policy;* **12**: No. 2, 101-118(1988).

The U.S. Department of Energy's Weatherization Assistance Program funds local agencies to provide weatherization services to low-income households. This paper describes the most salient features of this program and similar weatherization efforts, examines relationships between organization and program outcomes, and presents recommendations for improvements to weatherization programs and related activities. Data were collected from surveys completed by 133 local weatherization agenices, a telephone survey of 38 states and eight DOE support offices, and site visits to selected local agencies. Locally controlled factors found to be significantly related to program performance include the amount of the weatherization director's time spent on program administration, the use of established client selection criteria, the frequency of evaluation of local goal attainment, and the type of weatherization crews used. Factors controlled at state or federal levels that are related to program performance include delays in state reimbursements of coal agency expenditures and local flexibility in the choice of weatherization measures.

19772 **How influential is the auditor.** Brown, M.A.; Berry, L.G.; White, D.L.; Trumble, D. (Oak Ridge National Lab., Oak Ridge, TN (US)). *Energy Systems and Policy;* **12**: No. 2, 135-149(1988).

This paper examines the determinants of auditor effectiveness in selling energy conservation to homeowners and reports the results of an analysis of the effectiveness of the energy auditors employed by the Florida Power and Light Company. These auditors market five conservation incentive programs to residential customers. The analysis shows that closure rates (i.e., number of incentive program participants per 100 audits) vary widely across auditors and are highly dependent upon the nature of the households and homes being audited. After household effects are removed, the additional variation explained by auditor characteristics averages about 20%. Among all the auditor characteristics examined, extroversion is the best predictor of customer response. Those auditors rated as extroverted by their supervisors have customer participation rates 17% higher than the rates for introverted auditors. A standard sales aptitude test given to auditors does not distinguish effective from ineffective auditors. Similarly, high-performing auditors are as likely to have engineering as business educations.

19773 **Assessment of thermally activated heat pumps with desiccant cooling.** Turner, R.H.; Kleiser, J.D.; Chen, R.F.; Domingo, N.; Chen, F. (Univ. of Nevada, Reno, NV (US)). pp v of Proceedings of the American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. 1988 winter meeting. Volume 94, Part 1. Atlanta, GA; American Society of Heating Refrigeration and Air Cond. (1988). (CONF-880128—).

From ASHRAE winter meeting; Dallas, TX, USA (30 Jan 1988).

Two configurations of a thermally activated heat pump (TAHP) with a desiccant wheel for air drying are analyzed and compared to two conventional air conditions for summer space

cooling. Annual energy performance estimates are made for eight U.S. locations using historical data from the summer of 1986. Two system operational modes are considered: (1) ventilation mode and (2) recirculation mode. When the system operates in the ventilation mode - which pressurizes the house - the cooling load is reduced. The energy trade-offs and annual operating costs for each system in each of the eight locations are estimated.

19774 **Which types of analyses can be carried out with EMS data.** Cleary, P.G. (Lawrence Berkeley Lab., Univ. of California, CA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 2350-2359(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-28-3.

The Konsolen building is a high thermal mass 57-unit apartment building on the outskirts of Stockholm, Sweden. It is part of the Stockholm Project, a full-scale demonstration of energy-saving techniques. A large number of sensors were installed in the building for research purposes. However, they may not be needed for some types of analysis. It is of interest to see what could be learned if only typical EMS outputs were available. These include total electricity use, heat output from the heat pump, and heat supplied by the district heating main. It was found that the detailed sensors were essential in debugging the mechanical systems initially, but the EMS-type outputs are quite adequate to confirm that the building continues to operate normally. The building has such stable lumped parameters (average temperature, base load and thermal resistance) that detailed data are not needed to predict the average daily heat demand to within +-10%. However, neither the effect of the solar collectors nor the thermal mass of the building are visible in the EMS-type data.

19775 **Capabilities of in-place energy management systems for remote monitoring of building energy performance - Case studies.** Heinemeier, K.E.; Akbari, H. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 2321-2336(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-28-1.

Computerized Energy Management Systems (EMSs) are being installed in an increasing number of new and existing commercial buildings. While their primary function is to control building systems to save energy and power, many of these systems are also capable of monitoring the building systems and energy use. Using a case study approach, this paper evaluates the monitoring capabilities of the EMSs in two buildings in California. The retrieved data include historical hourly demand and outdoor air temperature, along with either instantaneous status or accumulated runtime data for each end use. The authors founds that an EMS, in order to monitor building energy performance, must reliably measure parameters that yield energy consumption information (end-use demand is most useful) and store this information long enough so that it can be retrieved. In many cases, minor additions to the hardware and software of an EMS could greatly enhance its monitoring capabilities.

19776 **Overview of the software-based federal residential conservation standard.** Lee, A.D. (Battelle Pacific Northwest Lab., Portland, OR (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 575-587(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper 3088.

Federal statute requires the Department of Energy to develop and issue energy conservation performance standards for residential buildings. The standard for federal construction has been completed and is unique because of its software-based format. Its unique characteristics and development process are relevant to ASHAE standard development activities. Federal agencies using the software will implement the standard by inputting necessary location, building type, equipment type, and conservation option information, and the software will produce a point-system compliance form. The software contains embedded cost and energy data used to derive the most cost-effective combination of conservation options. The point-system compliance form offers potential builders the energy-consumption information needed to determine design compliance or to perform trade-offs between alternative design options. This software serves as an alternative to complex graphs, tables, and calculations that would otherwise be needed to determine compliance with the cost-effective performance standard.

19777 **Effects of radiant heat exchange and mean radiant temperature on predicted heating energy savings.** Christensen, C.B. (Solar Energy Research Institute, Golden, CO (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 171-181(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper 3064.

For energy conservation measures, savings prediction typically involves calculation of a relatively small difference between two large numbers; e.g., building heating loads with and without the measure. Therefore, effects that are of small significance in building load calculations may warrant use of correction factors in savings calculations. In this study, two such effects have been investigated. First, radiant heat exchange between room surfaces depends on envelope U-values and is not adequately described by combined radiative/convective heat-transfer coefficients. Second, retrofits tend to increase mean radiant temperature, thus allowing lower thermostat settings and increased energy savings while maintaining equivalent thermal comfort. Correction factors have been developed to account for these effects in heating load calculations and in savings calculations. The adjustments for radiant heat exchange reduce heating loads and savings while the adjustments for mean radiant temperature increase heating loads and savings. Hence, the two effects tend to cancel. The adjustments are larger for savings calculations than for load calculations and are most significant for poorly insulated buildings.

19778 **Energy use test procedures for appliances: A case study of Japanese refrigerators.** Meier, A.K. *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1570-1577(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-13-2.

The energy test procedure provides a consistent measurement of refrigerator energy consumption, which can be used by engineers, utility forecasters, and consumers. The U.S. and Japanese test procedures for refrigerators differ significantly, so it is impossible to directly compare the performance of unique features, or even determine which units are more efficient. The energy use of 12 Japanese refrigerators (of which 9 were unique models) were measured under the U.S. DOE energy test procedure and compared to that reported by the manufacturers under the Japanese test procedure. The Japanese refrigerators used substantially more electricity with the DOE test.

19779 **The simulation and performance of a centrifugal chiller.** Jackson, W.L.; Chen, F.C.; Huang, B.C. (Computing and Telecommunications Div., Oak Ridge National Lab., Oak Ridge, TN (US); Efficiency and Renewables Research Section, Energy Div., Oak Ridge National Lab., Oak Ridge, TN (US); David Taylor Naval Ship, R and D Center, Annapolis, MD (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1751-1767(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-17-1.

A computer simulation model was developed to analyze the performance of a water-cooled centrifugal chiller. The model is based on a heat pump thermodynamic cycle and empirical correlations for the performance of the system components. The system simulated is composed of a variable-speed centrifugal compressor with a hot-gas bypass option for capacity control, two shell-and-tube heat exchangers, and an expansion device. The model was validated and calibrated against the experimental test results of a 125-ton chiller. The performance of a similar chiller system at various operating conditions and design modifications was analyzed. System performance comparisons were made between a baseline case, cases with high-performance heat exchanger tubes and compressor motor, and various variable-speed compressor operating strategies. It was found that significant performance improvement can be realized by using variable-speed drive and an on-demand control strategy.

19780 **Effects of fin pattern on the air-side heat transfer coefficient in plate finned-tube heat exchangers.** Beecher, D.T.; Fagan, T.J. (Westinghouse Electric Corp., Research and Development Center, 1310 Beulah Rd., Pittsburgh, PA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1961-1984(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-21-1.

The effects of air velocity, heat exchanger geometry, and fin patternation on air-side heat transfer in plate finned tube heat exchangers were investigated experimentally using a single-fin passage model. The geometric parameters considered included tube diameter, transverse tube spacing, longitudinal tube spacing, number of tube rows, and fin spacing. The effects of fin pattern depth and number of fin patterns per longitudinal tube row were investigated for a pattern consisting of corrugations of triangular cross-section transverse to the direction of airflow. The heat transfer data were correlated in terms of the dimensionless heat transfer coefficient (Nusselt number) based on the arithmetic mean temperature difference, Nu/sub a/, and the Graetz number, Gz, a dimensionless measure of the level of flow development.

19781 **Supplemental information from SP43 evaluation of system options for residential forced-air heating.** Locklin, D.W.; Herold, K.E.; Fischer, R.D.; Jakob, F.E.; Cudnik, R.A. (Energy and Thermal Technology Section, Battelle Columbus Div., Columbus, OH (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1934-1960(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-20-4.

ASHRAE Special Project 43 (SP43) has developed a dynamic simulation model for assessing the annual thermal performance and energy utilization of forced-war-air heating systems. Six previous papers on the SP43 project have described the model, its validation, and its use for evaluating system and control options, with the objective of generating information for the ASHRAE Handbook. A previous paper described the results of model predictions that showed the effect of system and control variables on overall performance. These variables include furnace and venting types, installation location and combustion air source, furnace sizing, night setback, thermostat cycling rate, blower operation strategy, basement insulation levels, duct sealing and insulation, house and foundation type, and climate. This paper describes the results of 25 additional model predictions that supplement those previously made -- including furnace sizing, climate for cases with night setback, blower afterrun control strategy, condensing furnaces with direct vents, closet furnace installations using attic air for combustion, and crawl-space furnace installations. The combined results of these predictions are expected to be the basis for information on annual system performance for the ASHRAE Handbook - 1988 Equipment Volume.

19782 **Seasonal performance evaluation of two horizontal-coil ground-coupled heat pump systems.** Johnson, W.S.; Baugh, R.N.; Griffith, W.A.; McGraw, B.A. (Univ. of Tennessee, Knoxville, TN (US); TECH Facility, Knoxville, TN (US); Univ. of Tenn., Knoxville, TN (US); Albert Bedinger Consulting Engineers, Knoxville, TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1875-1888(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-19-4.

Performance of two different ground-coupled heat pump installations in occupied single family residences in a Tennessee experimental facility is reported for the 1984-85 heating season and the 1985 cooling season. Hourly measurements of various power consumptions, heat flows, and temperatures were made over the entire seasons in order to determine overall system performance. The system in House I is a heating-only unit (field modified for cooling operation), which has been operating continuously since 1982. The second system is a water-air unit in House V of the facility. It was designated and installed by the private sector in November 1984 and has been tested over only one season. The seasonal performance factors of the House I system were found to be 2.23 and 1.51 for heating and cooling, respectively. The corresponding seasonal performance values of the new GCHP system in House V were found to be 2.84 and 2.59. System V performance is superior to system I primarily due to an increased length of ground coil and a heat pump having better cooling performance characteristics. A comparison of the GCHP system in House V with previously tested air-air heat pump systems shows that a well-designed GCHP system (with the ground coil sized for summer design conditions) offers a significant performance improvement over even a high efficiency air-air unit.

19783 **Effect of backfilling material on ground coil performance.** Mei, V.C. (Efficiency and Renewables Research Section, Energy Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1845-1856(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-19-2.

Ground-coupled heat pump (GCHP) systems use the ground as low-grade solar energy storage medium. Their high potential for energy conservation has long been recognized. However, the effect of ground coil backfilling material has never been seriously analyzed for GCHP applications. This paper presents a mathematical model to describe the operation of horizontal ground coils, which includes the effect of backfilling material. The model was validated with field experimental data, with overall error between calculated and measured total energy exchange between coil and ground of only 4.4% with the former on the conservative side. Three different backfilling materials were analyzed: clay, sand, and a fluidized mixture used for underground cable backfilling. The calculated results indicated that backfilling material made a big difference in coil performance. The fluidized mixture dissipates 47% more heat than the clay and 23% more than the sand. This model can be used to assess the effect of different kinds of backfilling materials. Improvements in coil performance versus cost of backfilling material can no be more realistically analyzed.

19784 **Carnot thermal efficiencies of chemical heat pumps operating between four temperature levels - A heuristic approach.** Ally, M.R. (Efficiency and Renewables Research Section, Energy Div., Oak Ridge National Lab., TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 2442-2453(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-29-4.

The Carnot coefficient of performance (CCOP) expression for heat pumps operating between four temperature levels is developed from first principles. The four temperature expressions may be used whenever the components are all at different temperatures. The derived Carnot COP expressions for four discrete temperatures become identical to the published ones representing three discrete temperatures when the two intermediate temperatures coalesce into a single value, thereby validating the result. A heuristic approach is then adopted to analyze some of the possible consequences of four-temperature cycles, especially regarding improvements in temperature lift and boost.

19785 **A computer model for simulation of absorption systems in flexible and modular form.** Grossman, G.; Gommed, K.; Gadoth, D. *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 2389-2428(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-29-2.

A computer code has been developed for simulation of absorption systems in a flexible and modular form, which makes it possible to investigate various cycle configurations with different working fluids. The code is based on unit subroutines containing the governing equations for the systems's components. Those are linked together by a main program according to the user's specifications to form the complete system. The equations are solved simultaneously, and fluid properties are taken from a property database. The code is user-oriented and requires a relatively simple input containing the given operating conditions and the working fluid at each state point. The user conveys to the computer an image of his cycle by specifying the different subunits and their interconnection. Based on this information, the program calculates the temperature, flow rate, concentration, pressure, and vapor fraction at each state point in the system and the heat duty at each unit, from which the coefficient of performance may be determined. The program has been used successfully to simulate a variety of single-stage, double-stage, and dual-loop heat pumps and heat transformers, with the working fluids LiBr-H/sub 2/O, H/sub 2/O-NH/sub 3/, LiBr/H/sub 2/O-NH/sub 3/, LiBr/ZnBr/sub 2/-CH/sub 3/OH and more.

19786 **Engine-driven heat pump performance analysis.** Fischer, R.D.; Jakob, F.E.; French, C.E. (Energy and Thermal Technology, Battelle Columbus Div., Columbus, OH (US); Mechanical Engineering, Battelle Columbus Div., Columbus, OH (US); Residential Heat Pumps, Gas Research Institute, Chicago, IL (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1046-1077(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-03-6.

This paper presents performance and cost information to assist designers in evaluating the selection of HVAC components, system configurations, values for component design variables, and operating strategies for natural gas engine driven heat pumps. A steady-state computer model for performance simulation of engine driven and electrically driven heat pumps was prepared and used for parametric and seasonal performance analyses. Parametric analysis showed the effect of variables associated with the design of recuperators, engine coolant coils, domestic hot water heat exchangers, compressor size, engine efficiency, and insulation levels on engine exhaust and coolant piping. Seasonal performance data were prepared for residential and commercial units in six cities with system configurations closely related to existing or contemplated engine hardware. Similar data were prepared for an advanced variable-speed electric unit for comparison purposes. The effect of domestic hot water production on operating costs was determined and four fan operating strategies were explored.

19787 **Steady-state refrigerant flow and airflow control experiments for a continuously variable speed air-to-air heat pump.** Miller, W.A. (Efficiency and Renewables Research Section of the Energy Div. of Oak Ridge National Lab., TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1191-1204(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-05-4.

A continuously variable speed, air-to-air split-system residential heat pump of nominal 2 3/4-ton (9.7-kW) capacity was instrumented and tested in the laboratory. The coefficient of performance (COP), capacity of the system, and component efficiencies were measured during steady-state heating- and cooling-mode operation. The indoor blower speed and the refrigerant subcooling at the condenser exit were varied at discrete compressor speeds to determine the best COP as constrained by residential comfort requirements. Heating- and cooling-mode test results showed a 10% improvement in COP for operation with a variable area throttle as compared with a capillary tube throttle. Improved control of refrigerant flow and reduction of the indoor blower speed improved humidity control. As compared with results for capillary tube flow control, the sensible heat ratio was reduced from 0.95 to 0.77 at 15-Hz compressor speed.

19788 **Further developments in the design of a free-piston Stirling engine heat pump for residential applications.** Ackerman, R.A.; Clinch, J.M.; Privon, G. (Residential Heat Pumps at Mechanical Technology Inc., Latham, NY (US); Gas Research Institute, Chicago, IL (US); Oak Ridge National Lab., Oak Ridge, TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1006-1020(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-03-3.

During the past year (1986/1987), the development of an improved Stirling engine driver for the Free-Piston Stirling Engine Heat Pump (FPSE/HP) has led to a significant increase in heat pump performance. With the improved engine, the MARK I, the FPSE/HP has achieved its two critical milestones of producing k3.0 refrigeration tons (RT) at the 95 F (35°C) ambient temperature conditions and an engine efficiency of 25%, as measured from the fuel input energy, based on the higher heating value of the natural gas and mechanical power developed by the engine. This paper describes the latest configuration of the FPSE/HP module and presents measured performance data. Performance has been measured over a broad range of ambient temperature conditions and engine operating parameters. The results obtained from this testing are presented.

19789 **Energy measurements of single-family houses with attics containing radiant barriers.** Levins, W.P.; Karnitz, M.A. (Energy Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 182-199(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper 3065.

A national laboratory has tested radiant barriers in attics of three unoccupied research houses, which are located near Knoxville, Tennessee. The prime purpose of the testing was to determine the interaction, if any, between two types of radiant barriers, horizontal (barrier laid on top of attic insulation) and truss (barrier attached to underside of roof trusses), and three levels of fiberglass-batt attic insulation, R-11, R-19, and R-30. Testing of radiant barriers with R-19 fiberglass-batt attic insulation was done at the houses in the summer of 1985 and in the winter of 1985-86. The R-11 and R-30 testing was done in the summer of 1986. These results

showed that horizontal barriers were more effective than truss barriers in reducing house cooling and heating loads.

19790 **Building wall heat flux calculations.** Park, J.E.; Kirkpatrick, J.R.; Tunstall, J.N.; Childs, K.W. (Martin Marietta Energy Systems, Inc., ORGDP, Oak Ridge, TN (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 120-136(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper 3061.

Calculations of the heat transfer through the standard stud wall structure of a residential building are described. The wall cavity contains no insulation. Four of the five test cases represent progressively more complicated approximations to the heat transfer through and within a hollow wall structure. The fifth adds the model components necessary to severely inhibit the radiative energy transport across the empty cavity. Flow within the wall cavity is calculated from the Navier-Stokes equations and the energy conservation equation for an ideal gas using the Implicit Compressible Eulerian (ICE) algorithm. The fluid flow calculation is coupled to the radiation-conduction model for the solid portions of the system. Conduction through sill plates is about 4% of the total heat transferred through a composite wall. All of the other model elements (conduction through wall board, sheathing, and siding; convection from siding and wallboard to ambients; and radiation across the wall cavity) are required to accurately predict the heat transfer through a wall. Addition of a foil liner on one inner surface of the wall cavity reduces the total heat transferred by almost 50%.

19791 **Simultaneous measurements of infiltration and intake in an office building.** Persily, A.K. (Center for Building Technology, National Bureau of Standards, Gaithersburg, MD (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 42-56(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper 3057.

Tracer gas decay measuring techniques exist to determine whole building air exchange rates. This paper presents two new measuring techniques to determine simultaneously both the amount of air exchange due to intentional outdoor air intake and the amount due to uncontrolled envelope infiltration. One of these techniques was applied to a new office building as a demonstration of the procedure, and to investigate the air exchange characteristics and mechanical ventilation system performance in this particular building. Using a tracer gas measuring technique in combination with multithermistor airflow-rate measuring systems, intake and infiltration rates were measured under a range of weather conditions and outdoor air intake rates. The results indicate that the outdoor air intake rates for this building are often well below their design values, a significant percentage of the net air exchange rate of the building is due to envelope leakage, and the amount of envelope leakage is dependent primarily on the outdoor air intake rate.

19792 **International developments in heat pump technology.** Creswick, F.A. (Building Equipment Research Program, Oak Ridge National Lab. (US)). pp v of Energy technology XIV. Rockville, MD; Government Institutes Inc. (1987). (CONF-870416—).

From 14. annual energy technology conference and exposition; Washington, DC, USA (14 Apr 1987).

The thesis of this presentation is that heat pump technology is at present well diffused throughout Western Europe, Japan, and North America, but differences in climate, fuel availability and pricing, and conventional heating, ventilating, and air conditioning (HVAC) practice have resulted in uniquely different products in each region. Moreover, present differences in the heat pump market situation are affecting the directions and vigor of future R and D efforts in each region.

3202 Transportation

REFER ALSO TO CITATION(S) 19705

19793 **(ADI—8309) Effects of highway geometry and surface conditions on vehicle operating costs in Canada. Final report.** (Adi Ltd., Fredericton, New Brunswick (Canada)). 1983. 27p. (CE—02053). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Vehicle running costs represent a comprehensive measure of the overall efficiency of the highway system, since they reflect the effects of vehicle operating characteristics, engine fuel efficiency, roadway geometry, traffic operating conditions, and the overall physical condition of the highway plant. Historically, these costs have been based on data which are now out of date or not optimally applicable to Canadian conditions. This paper presents results of studies intended to determine what data are required to obtain the best possible motor vehicle operating costs representative of Canadian conditions, and a data collection program is designed to address these requirements. Specific data requirements for Transport Canada's needs, but limited according to budget constraints, are discussed with respect to vehicle types, vehicle operating speed range, gradients and curvatures, surface conditions, environment, and influence of roadway geometrics and traffic levels. Relevant research available to address these data requirements, data shortfalls and Transport Canada's testing capabilities is reviewed. The recommended data collection program involves the testing of two automobiles, a straight truck and one tractor-trailer, this being a selection of vehicles that represents the most common types found on Canadian highways. Specific data shortfalls to be addressed include the effects of surface roughness and horizontal curvature on fuel consumption, the effects of cold weather, and the effects of various parameters acting in combination as well as individually. 4 tabs.

19794 **(CUTA—TP6176E) Urban transit research and development inventory of projects and value analysis.** (Canadian Urban Transit Association, Toronto, ON (Canada)). 1985. 357p. (CE—02394). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report documents current research, development, and demonstration projects in the Canadian urban transit sector for the 1983-84 period. Data were compiled from questionnaires returned by over 100 agencies including governments, transit operators, manufacturers and suppliers of transit equipment, universities, and private research organizations. Descriptions of 276 projects are included and under each project is given financial and administrative information, the purpose of the project, the research methodology used, project results and conclusions, and further research work identified. An analysis is also presented of the value of each individual project from the perspective of transit operators and federal and provincial government agencies. Activities are concentrated in three main areas: vehicle/system technology development, computer applications and development, and transportation planning and management. The largest number of projects in a single research area involves alternative energy vehicles and/or alternative fuels. Includes indexes according to agency and subject area. 3 figs., 11 tabs.

19795 **(DE—82-161-4) Further comparisons between passenger car fuel consumption in standard dynamometer tests and on the road.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). 1984. 117p. (CE—02406). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objectives of this project were to experimentally determine fuel consumption values over-the-road for various average trip speeds on selected vehicles, establish a preliminary relationship between fuel consumption and vehicle speed and to compare those values to dynamometer laboratory results. The scope of this project was limited to designing a driving route, estalishing an experimental procedure, performing on-road testing and analysing and reporting

the results. Twelve passenger cars were utilized in the evaluation. Road tests were performed on 5 road sections representative of low speed urban, medium speed urban, suburban, highway, and expressway driving. Based on the results the following conclusions are drawn. For all but one vehicle the results of the dynamometer tests exceeded the Transport Canada Guide Book values. The results of the on-road tests performed correlated more closely to the results of the dynamometer tests than to the Guide Book values. For the on-road tests the lowest fuel consumption was obtained on the highway test section, the highest on the low speed urban section, and the second highest on the medium speed urban section. In general, the driver with the highest average speed over a particular test section also experienced the highest fuel consumption value. An abundance of data has been created, which when further analyzed will provide a valuable basis for explaining the differences in fuel consumption obtained through testing on the dynamometer as compared to over the road. 29 figs., 19 tabs.

19796 **(DE—83-12-4) Evaluation of excess fuel consumption associated with cold starting of passenger cars. Final report.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). 1984. 149p. (CE—02408). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This project was undertaken to generate fuel consumption and temperature data for vehicle cold starting and warmup under various conditions as found in Canada, in order to help understand the effects that cold starting and warmup have on total fuel consumption. Twelve automobiles (two of which were diesel-powered, the rest gasoline) were tested, and vehicle cooldown characteristics were also determined. Tests were carried out under a variety of ambient temperature conditions over the year. The time for the vehicle to reach normal operating conditions was longest for the idle warmup tests and shortest for the highway warmup tests. Conversely, in most cases, the least fuel was used during the idle warmup and the most during the highway warmup. There was a substantial increase in fuel consumption for the warmup tests performed, over testing on a fully warmed-up vehicle. The average increase was 74% for the idle warmup tests, 38% for the urban warmups and 87% for the highway warmups. The increase in fuel consumption was significantly greater for tests performed on the gasoline powered vehicles than for the diesel vehicles. The fuel consumption penalty increased as ambient temperature decreased, as a general rule, for the vehicles tested. In the cooldown tests, it was observed that there was an initial increase in coolant temperature immediately after engine shutdown followed by a gradual decrease in temperature for tests performed in the normal mode. 5 refs., 55 figs., 23 tabs.

19797 **(DE—8506) Development of vehicle utilization monitors. Phase 1, feasibility.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). 1985. 203p. (CE—02407). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A study was undertaken to assess the feasibility of developing a low-cost on-board monitor to accumulate data on the vehicle utilization variables that determine fuel consumption. Current research on utilization influences on fuel economy was reviewed, and the variables required to be recorded by a vehicle monitor to accurately map vehicle usage were determined. In determining the engineering feasibility of measuring those variables, a survey was made of data acquisition systems presently on the market, and a review was performed on current research. Appropriate transducers, capable of being used in a wide variety of passenger vehicles, were selected, and the sampling requirements were examined. A preliminary design was then carried out on all the components of a vehicle utilization monitoring program, including sampling plans, a block-level design of the monitor, sensor selection, data analysis needs, reporting requirements, and cost estimates. The equipment survey did not find any data acquisition systems that were ideally suited to the vehicle monitoring application. A custom design was felt to be the most cost-effective way to satisfy the system specifications. Vehicle utilization can be adequately characterized using just 6 sensors to monitor gradient, distance, power/coasting, ambient temperature, coolant temperature and time. On-board data reduction will enable data handling by inexpensive software and computers. Overall, there are no technical obstacles to producing a relatively low-cost monitoring system. 8 refs., 7 figs., 14 tabs.

19798 **(DE—8603) Rolling resistance and fuel consumption investigations. Part A, fuel consumption studies. Final report.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). 1986. 43p. (CE—02404). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A rig has been developed for measuring over-the-road truck tire rolling resistance and bearing moment. The rig has also been instrumented to also measure fuel consumption rate and drive shaft torque. The objectives of the research described in this report was to provide a means of relating rolling resistance directly to fuel consumption. An on-road engine map (fuel consumption rate versus power) was developed for the Truck Tire Rilling Rig (TTRR) and it was found to compare favorably with the manufacturer's engine map. The capabilities of the TTRR have been further broadened through the correlation of the rolling resistance of various test parameters such as tire inflation pressure, vehicle speed, road surface conditions and bearing oil temperature on fuel consumption rate. Examination of several case studies shows that as much as 11% of the fuel rate is required to overcome the rolling resistance of the four tires on the test axle. In addition a decrease in tire inflation pressure from 517 to 362 kilopascals resulted in a 19% and 25% increase in fuel consumption rate over gravel and paved road surfaces, respectively, at 40 km/h. On the average, fuel consumption rate over a gravel road at 40 km/h was about 45% higher than over a paved surface. A bearing oil temperature increase from 12 to 40/sup 0/C resulted in a 40% reduction in fuel consumption rate at 60 km/h. 16 figs., 7 tabs.

19799 **(DE—C81-182) Evaluation of truck tire rolling resistance. Phase 3.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). 1984. 122p. (CE—02405). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A project was undertaken to design, fabricate and install a sysem measuring the rolling resistance of truck tires as well as the coupling losses. Specific objectives of this phase of the project were to verify the effects of ambient temperature on the force-measuring bridge, to optimize the data reduction process, to verify the performance of the system in measuring the rolling resistance of radial and cross-ply tires which had been previously submitted to laboratory testing, and to carry out bearing moment tests. The results of the tests indicate the following. The ambient air temperature affects measurement of rolling resistance, but it is possible to correct such measurements. Gravel roads bring about an increase in rolling resistance of ca 40-50% compared to paved roads. Rolling resistance decreases with an increase in tire pressure. A cross-ply tire has about 15% more rolling resistance than a radial tire. Rolling resistance measured on a paved road is slightly larger than that measured in the laboratory. The measuring system was found to be very stable and gave results similar to those obtained in the laboratory. Coupling losses decrease to the extent that the oil temperature in the bearings increases. 43 figs., 13 tabs.

19800 **(DOE/NASA/50111—3) Gas turbine alternative fuels combustion characteristics.** Rollbuhler, R.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Feb 1989. Contract AI01-85CE50111. 26p. (NASA-TM—101470). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008330/JAW.

An experimental investigation was conducted to obtain combustion performance and exhaust pollutant concentrations for specific synthetic hydrocarbon fuels. Baseline comparison fuels used were gasoline and diesel fuel number two. Testing was done over a range of fuel to air mass ratios, total mass flow rates, and input combustion air temperatures in a flame-tube-type gas turbine combustor. Test results were obtained in terms of released heat and combustion gas emission values. The results were comparable to

those obtained with the base fuels with variations being obtained with changing operating conditions. The release of carbon particles during the tests was minimal. 22 refs., 12 figs., 2 tabs.

19801 **(FERIC—8404) Study of logging truck fuel consumption. Phase 1.** Smith, D.G. (Forest Engineering Research Inst. of Canada, Vancouver, British Columbia). 1984. 18p. (CE—02403). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Optimization of log hauling in British Columbia necessitates the best possible matching of trucks, roads, and management. Understanding how the truck is operating is vital in evaluating improvements to either the road or the truck. This can be done by determining major operating parameters, such as fuel consumption and travel speed, of a truck and relating them to operating conditions and truck design. As part of a research project on logging trucks, fuel flow metering equipment and a data acquisition system were installed on a typical logging truck. This report covers the first phase of this research, describes the truck's instrumentation and summarizes data from eight hauls. The data are evaluated and operational problems encountered with the equipment are outlined. 9 figs., 4 tabs.

19802 **(FERIC—8510) Study of logging trucks fuel consumption. Phase 2.** Sinclair, A.W.J.; Wakefield, R.D.C. (Forest Engineering Research Inst. of Canada, Vancouver, British Columbia). 1985. 29p. (CE—02409). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this research was to determine the effects of various road-design standards on the operating conditions of logging trucks operating in the British Columbia interior. This report describes the monitoring equipment and data acquisition system used, and the field experience with data collection in 1984-85. Problems with equipment meant that only a limited amount of data was collected, limiting the conclusions that could be drawn. The major problems were engine power losses caused by the fuel-metering system, the recurring failures of the data acquisiton system, and equipment failures with the accelerometer. Improvements were made to the fuel-metering system and by the end of the test period it was working reliably. The other equipment is to be modified before the next phase of research starts. The data-reduction software was streamlined and works satisfactorily, and additional software has been developed to provide graphical representation of the truck and road data. From these graphs, the basic variations in fuel consumption and truck speed vs truck load, road grade, and road surface were demonstrated. An increase in drive-tire slippage was noted between empty and loaded trucks on gravel roads but the cause could not be determined. The operating temperatures of the differentials in moderately cold temperatures were observed to be within the manufacturer's specifications. 12 figs., 7 tabs.

19803 **(TC/RS—TSR-85-T-02) Reduction of the fuel economy penalty associated with the operation of road vehicles at low ambient temperatures. Final report.** (Transport Canada, Ottawa, Ontario. Road Safety). 1985. 121p. (CE—02392). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A test program was designed and conducted to determine the effectiveness of various technical countermeasures in reducing the fuel economy penalty associated with operation of road vehicles at low ambient temperatures, specifically during transient warmup conditions. The technical countermeasures evaluated were: exhaust heated engine coolant; exhaust heated passenger compartment; and use of various oils with additives to reduce their viscosities. Three vehicles of identical basic cofiguration were utilized for this test program. Each vehicle was modified so that it could be tested in base configuration and also with one or two test variables over a range of ambient temberatures from +20/sup 0/C to -20/sup 0/C in 10/sup 0/C + intervals. Each countermeasure and base configuration were tested in each temperature range with up to four or five test replicates whenever test conditions and instrumentation function would allow. A total of 140 successful tests were conducted during the program in addition to others which were rendered invalid. Various temperatures, fuel flow and vehicle speed were measured during each test. One of the countermeasures (Flo-Tech engine oil additive) produced a significant decrease in fuel consumption and a second countermeasure (030 oil) produced a noticeable decrease in fuel consumption relative to 10W30 oil. One other countermeasure (exhaust heated coolant), while not producing a significant decrease in fuel consumption, did produce a potentional improvement in heater/defroster operation and passenger subjective comfort by increasing coolant warmup rate. Two other countermeasures (5W30 oil and heater system coolant bypass) did not exhibit a significant decrease in fuel consumption. 28 figs., 16 tabs.

19804 **(TCS—8507) Energy and economic impact of shift to trailers on flat cars (TOFC) operation. Final study report.** (Trimac Consulting Services Ltd., Calgary, AB (Canada)). 1985. 160p. (CE—02402). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Objectives of this study are to identify the trailer on flat car (TOFC) market in Canada, quantify movements and forecast future movements, and compare energy used and transportation costs in TOFC vs on-highway trucking. Noting that TOFC activity represents only 2% of rail tons carried, and recognizing recent investments in TOFC and promotion of that service by railways, linear growth trends were fitted (by province) to historic TOFC data to arrive at reasonable forecasts. Recognition was also made of potential improvements to TOFC technology; in an optimistic scenario, TOFC activity in Canada was forecast to grow to as much as 8.9 million tons by 1995. The TOFC market was also discussed in terms of decision factors by those concerned with the service, and by types of commodities susceptible to the service. Possible competition from container-on-flatcar service was also briefly considered. In examining energy-related aspects of TOFC, four corridor case studies were analyzed. In terms of energy used, TOFC appears to provide fuel savings of 30-60% compared to highway trucking. In terms of total economic cost, TOFC tends to have significant advantage only for the longer-distance corridors; for the 350-mile Toronto-Montreal corridor, the two costs were close enough to permit TOFC to compete aggressively with truck. Pricing strategy for TOFC is discussed in general terms, and example tariffs are presented which generally tend to support the economic costing results from the case studies and also illustrate likely opportunities for earning higher margins on long distance corridors such as Toronto-Vancouver. 33 refs., 4 figs., 11 tabs.

19805 **(TU—8309) An interim report on disaggregate modelling of Canadian vehicle ownership, trip-making and fuel usage.** Berkowitz, M.K.; Gallini, N.; Miller, E.J.; Wolfe, R.A. (Toronto Univ., Ontario (Canada); York Univ., Toronto, Ontario (Canada)). 1983. 121p. (CE—02370). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report consists of a review of past modelling efforts in the area of disaggregate vehicle ownership and usage; the development of a theoretical model of vehicle holdings and usage for one-vehicle households; the collection of the required data base; a brief descriptive analysis of Canadian vehicle holdings based on these data; and a preliminary set of model estimations for the one-vehicle case. An objective of this research is to develop and eventually use a model, suitable for analysis of Canadian energy policies, that could predict governmental and economic impacts on vehicle demand, usage, and fuel consumption. The problems found with previously developed models, including questionable applicability to Canada, data set limitations, and lack of theoretical consistency, showed issues involved in model development for this project. The data collection involved design of a survey questionnaire, commissioning the survey and analyzing the results; data obtained from 2000 households were compared with Statistics Canada data to verify data quality. In developing the model, assumptions were made regarding decision making in households to arrive at a nested choice model involving a multinomial probit functional form. Preliminary model estimation results are based on a limited sample of

ca 300 households and result in usage models of limited explanatory power and difficulties in obtaining even a marginally successful holdings model. It is believed that more satisfactory results can be obtained once the entire sample of one-vehicle households is used. 41 refs., 8 figs., 21 tabs.

19806 **(UCRL—98520) Initiative for the 21st century: Advanced space power and propulsion based on lasers.** Logan, B.G. (Lawrence Livermore National Lab., CA (USA)). 1 Feb 1989. Contract W-7405-ENG-48. 25p. (CONF-8804249—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008034/JAW.

From Initiative for the 21st century: advanced space power and propulsion based on lasers; Cleveland, OH, USA (25 Apr 1988).

This paper discusses the use of lasers in spacecraft propulsion systems. Cost, efficiencies and comparisons with other propulsion systems are discussed. (LSP)

19807 **(DOE/NE/32134—T1-Vol.3-Bk.2) Final safety analysis report for the Galileo mission: Volume 3 (Book 2), Nuclear risk analysis document: Appendices: Revision 1.** (NUS Corp., Gaithersburg, MD (USA)). 25 Jan 1989. Contract AC01-87NE32134. 203p. (NUS—5126-Rev.1-Vol.3-Bk.2). NTIS, PC A10 - OSTI. Order Number DE89007273/JAW.

It is the purpose of the NRAD to provide an analysis of the range of potential consequences of accidents which have been identified that are associated with the launching and deployment of the Galileo mission spacecraft. The specific consequences analyzed are those associated with the possible release of radioactive material (fuel) of the Radioisotope Thermoelectric Generators (RTGs). They are in terms of radiation doses to people and areas of deposition of radioactive material. These consequence analyses can be used in several ways. One way is to identify the potential range of consequences which might have to be dealt with if there were to be an accident with a release of fuel, so as to assure that, given such an accident, the health and safety of the public will be reasonably protected. Another use of the information, in conjunction with accident and release probabilities, is to estimate the risks associated with the mission. That is, most space launches occur without incident. Given an accident, the most probable result relative to the RTGs is complete containment of the radioactive material. Only a small fraction of accidents might result in a release of fuel and subsequent radiological consequences. The combination of probability with consequence is risk, which can be compared to other human and societal risks to assure that no undue risks are implied by undertaking the mission. Book 2 contains eight appendices.

19808 **(DOE/NE/32134—T1-Vol.3-Bk.1) Final safety analysis report for the Galileo mission: Volume 3 (Book 1), Nuclear risk analysis document: Revision 1.** (NUS Corp., Gaithersburg, MD (USA)). 13 Jan 1989. Contract AC01-87NE32134. 89p. (NUS—5126-Rev.1-Vol.3-Bk.1). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007272/JAW.

It is the purpose of the NRAD to provide an analysis of the range of potential consequences of accidents which have been identified that are associated with the launching and deployment of the Galileo mission spacecraft. The specific consequences analyzed are those associated with the possible release of radioactive material (fuel) of the Radioisotope Thermoelectric Generators (RTGs). They are in terms of radiation doses to people and areas of deposition of radioactive material. These consequence analyses can be used in several ways. One way is to identify the potential range of consequences which might have to be dealt with if there were to be an accident with a release of fuel, so as to assure that, given such an accident, the health and safety of the public will be reasonably protected. Another use of the information, in conjunction with accident and release probabilities, is to estimate the risks associated with the mission. That is, most space launches occur without incident. Given an accident, the most probable result relative to the RTGs is complete containment of the radioactive material. Only a small fraction of accidents might result in a release of fuel and subsequent radiological consequences. The combination of probability with consequence is risk, which can be compared to other human and societal risks to assure that no undue risks are implied by undertaking the mission. 4 refs., 11 figs., 31 tabs.

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REFER ALSO TO CITATION(S) 19456, 19546, 19547, 19547, 19553, 19689, 19735, 19736, 19870, 20323, 20501

19809 **(AQR—8804) Listing of engineering research contract reports under the DREAM, AERD and ERDAF programs of the Research Branch, 1973-1988.** Morrison, B.A.; Thuns, A.; Feldman, M. (Air Quality Research, Toronto, Ontario (Canada)). 1988. 188p. (MICROLOG—88-04250). Canada. Agriculture Canada. Research Station, Research Branch, Swift Current, SK, Canada S9H 3X2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

To supplement in-house investigations, Agriculture Canada contracted out research in a number of programs including three which supported engineering work. This document lists the contracts awarded under the programs and provides reference citations of the contract reports. Reports are grouped by file number, scientific authority, author or contractor, and subject, and a subject index is also included. The three programs are: Development, Research and Evaluation in Agricultural Mechanization (DREAM), Agricultural Engineering Research and Development Program (AERD), and Energy Research and Development in Agriculture and Food (ERDAF). AERD, which replaced DREAM, has been terminated, but the ERDAF program is still continuing as of the date of this document.

19810 (CGA—1988, pp 4) **Garland's energy-saving technology in the commercial food service industry.** Ross, B.W. (Garland Commercial Ranges Ltd.). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

The food service industry in Canada is estimated to be a $22 billion industry, responsible for more than 5% of gross domestic profit. The industry is projected to grow by 26% in the next 8 years, making it Canada's largest job creator. In the fast food segment specifically, the gas/electric appliance split is 90%:10% and in the entire food service industry it is likely a 85%:15% split. A latest innovation has been high efficiency fryers which provide the same productivity as units rated at 140,000 BTUs but now use only 80,000 BTUs. Growth and success in the food service industry is fueled by gas appliances; high standards of commercial cooking equipment should be maintained to ensure quality, safety and performance.

19811 (CGA—1988, pp 14) **An overview of industrial and commercial cogeneration.** Gall, D.P.; Burdette, A.M. (Cooper Industries). 1988. Canadian Gas Association, Operating Services, 55 Scarsdale Rd., Don Mills, Ont., Canada M3B 2R3; $0.25 PER PAGE CAN. (CONF-8810325—; CE—02492).

From C.G.A. 1988 marketing conference; Ottawa, Canada (16 Oct 1988).

This paper discusses the evolution of cogeneration in the United States and then focusses more closely on industrial and commercial cogeneration applications. Cogeneration is defined as the combined production of useful thermal energy and electric power from a single fuel source. The basic cogeneration cycles can be classified into two types depending on whether electrical or thermal energy is produced first. A topping cycle system first produces electrical power and the waste heat is then used for thermal energy. A bottoming cycle system has thermal energy produced first for a process use and exhaust heat recovered to generate low pressure steam for the production of electricity. These are only found when an industrial process needs high temperature heat. Following an explanation of cogeneneration evolution in the USA, the author provides some applications of cogeneration in the industrial and commercial sectors. A facility studied and installed at the Indi-

ana University of Pennsylvania is described as a cogeneration project example. 7 figs.

19812 **(CONF-8711290—1) Development and operation of an efficient cyclonic incineration demonstration system for industrial wastewater.** Khinkus, M.J.; Kunc, V.; Romanovich, P.J. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 23p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007168/JAW.

From American Flame Research Committee fall international symposium; Palm Springs, FL, USA (2 Nov 1987).

The cyclonic combustion concept, which provides high combustion- intensity and high combustion-efficiency with low excess air, offers many advantages for waste incineration over commercially available incinerators. The cyclonic incinerator allows better mixing and temperature uniformity, higher destruction efficiency, a wider range of operating parameters, greater flexibility to variation in waste properties, dry ash and/or molten slag operation, and more efficient heat recovery at reduced capital and operating costs. On the basis of successful results of the pilot-scale tests, the cyclonic incineration demonstration system has been jointly developed and operated by the Institute of Gas Technology (IGT), York-Shipley, Inc. (Y-S), and an industrial client. The demonstration system consisted of a wastewater handling subsystem; a compact cyclonic incinerator with an ash/slag receiver, capable of operating either in dry or slagging modes; a heat recovery boiler; an air heater; and a baghouse. 7 figs., 3 tabs.

19813 **(CONF-8808199—1) Thermal reclamation of used blast grit.** Sandstrom, W.A.; Patel, J.G. (Institute of Gas Technology, Chicago, IL (USA)). 24 Aug 1988. 11p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007150/JAW.

From Ship production symposium; Seattle, WA, USA (24 Aug 1988).

Four reclaimer feasibility tests were conducted with used blast grit from the Long Beach Naval Shipyard. The results of these tests revealed that the organic material component of the used grit was fully oxidized to carbon dioxide and water. Some of the metallic oxides of copper, zinc, titanium, and lead from the used grit were largely elutriated into a cyclonic collector. The calcined (reclaimable) fraction from this test work amounted to approximately 95% of the used grit charged. The major oxide and organic component analyses conducted revealed no significant general chemical difference between the virgin and reclaimed grit. Based on these results, a commercial plant can be designed to provide a reusable grit yield in excess of 80% within the general size specifications. 2 refs., 4 figs., 9 tabs.

19814 **(DOE/CE/15367—T2) High pressure liquid jet for disintegration of wood: Technical progress report for the period October 1, 1988--December 31, 1988.** (Incubator Technologies, Inc., Rolla, MO (USA)). 1988. Contract FG01-88CE15367. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006088/JAW.

Based on the results described in Technical Progress Report No. 1, it was decided to continue with those tests using a combination of mechanical cutting tool with waterjet. The mechanism of cutting wood by mechanical tool, oriented in such a way that the rake angle is negative, creates some kind of analogy to the pulping by grinding. A negative rake angle develops compression stress on a portion of the wood which is in front of the rake face, before the chip is formed. Compression developed on the fibers helps to separate them and form pulp. To check how well it works, a series of tests was carried out for negative rake angle, as well as for cutting tool tip, rounded to radius of 0.125 inches. 5 figs., 2 tabs.

19815 **(DOE/ID/12559—1) Development of a heat flux dew-point hygrometer for harsh and fouling environments: Final report.** (Trans-Met Engineering, Inc., Anaheim, CA (USA)). Jun 1988. Contract FC07-85ID12559. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008082/JAW.

The program summarized in this report was initiated for the purpose of developing a practical economic hygrometer for use in high temperature harsh and fouling industrial driving environments. The need for such a sensor was based on the fact that a successful measurement of the moisture content of the air in such environments could greatly improve drying efficiencies with attendant significant energy saving. At the time of the initiation of the program there were no sensors commercially available for such measurements. 4 refs., 9 figs.

19816 (EMR/E—1976, pp 61-68) **Fuel and the Portland cement industry.** Redfern, J.D. (Canadian Cement Lafarge Ltd.). 1976. Department of Energy, Mines and Resources, Ottawa, Ontario. (CONF-8609466—; CE—02127).

From 28. Canadian conference on coal; Ottawa, Canada (26 Sep 1986).

This paper presents an introduction to the technology and energy sources used in the Canadian cement industry. Energy accounts for 42% of total production costs, and most of this energy is used in the cement kiln. In recent years an shift has been observed away from oil and gas and towards coal as a source of this energy. There also has been an increase in kiln efficiency since the 1920s, although it would not be cost-effective to convert all cement plants to the most efficient type of kiln. Given the proper investment climate, this improvement to more efficient plants and increased use of coal could be accelerated. Substitution of non-conventional fuels, such as municipal wastes, is also considered, but further study is required. 3 figs., 3 tabs.

19817 **(EPRI-CU—6247) Microwave vacuum drying of food products: Final report.** Petrucci, V.E.; Clary, C.D. (Electric Power Research Inst., Palo Alto, CA (USA); California State Univ., Fresno, CA (USA). Viticulture and Enology Research Center). Feb 1989. 91p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

A combination microwave/vacuum drying system (MIVAC) was used during 1987 to produce puffed dried grapes and other fruits in order to evaluate product quality and MIVAC system performance characteristics. The vacuum reduces the temperature necessary to dry the fruits and minimizes oxidation of the product. The microwave energy provides optimum heating to dry the product. The dried fruit product maintains the characteristics of fresh fruit with respect to color, flavor, and appearance using no chemical treatments for preservation. To improve the throughput and drying efficiency of the MIVAC unit, an oxygen-restricted convection dryer and a liquid medium drying system were tested. During the project, effect of fruit type and composition was evaluated to determine unit performance characteristics. Dried product was analyzed for nutritional value and storage stability. The system was evaluated for technical feasibility and possibility of commercialization. The MIVAC system incorporating a liquid medium predryer system demonstrates potential for commercialization. The dried puffed product maintains enhanced nutritional value in concentrated amounts due to the removal of water from the fruit. 10 figs., 12 tabs.

19818 **(LITH-IKP-R—500) Efficient industrial energy systems. Unit processes - technical level and potential of development.** Bjoernskaer, K.; Soederstroem, M. (Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering). 11 Dec 1987. 101p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757049/JAW.

In this report the industrial processes are divided into unit processes. In order to establish the knowledge base concerning the energy efficiency of industrial processes, a literature study has been carried out. Out of comprehensive material from seven data bases about 300 publications have been chosen. The result from the literature study indicates the transition from processes using fuels to electricity using processes. The investigation has been carried out considering different economical and technical view-points. The results in form of values of specific factors for energy utilization are therefore difficult to compare. The possibilities for development for the individual unit processes are dealt with by utilizing information from research institutions and from manufacturing companies. Different technologies are on different stages of development concerning commercial products and will therefore to a different extent influence the energy utilization of the industry. In the final chapter of the report trends for energy utilization are studied for some of the

unit processes. Economizing in fuel based processes can be derived from a change over to more up to date - in many cases - electric power. The development aims at decreasing factors for energy use per unit produced even for processes considered to be specifically demanding electric power. (L.F.).

19819 **(OAEC—8801) Reclaiming corn drying energy.** Winfield, R.G.; Spieser, H. (Ontario Agriculture Energy Centre, Guelph (Canada)). 1988. 4p. (CE—02310). Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C.

High-temperature drying of grain corn is fast and effective but uses a lot of energy. In Ontario, corn producers use the equivalent of 120 million liters of propane per year; this amount could be reduced by at least 20% using some of the energy-reclaiming techniques and equipment outlined in this report. Methods of reclaiming heat energy involve either heat recirculation or the use of heat exchangers. Heat recirculation includes not only redirection of the warmed cooling air to the drying fan, but also recirculation of air from the lower portion of the drying section. Calculation shows that savings on the order of 30% are realistic targets, especially at low ambient air temperatures. Design considerations for heating/cooling fan dryers are listed. Heat exchangers can permit heat reclaiming even from near-saturated drying air, as heat only is transferred from the hot exhaust air to the cooler incoming air. Heat exchangers can be applied to continous flow or batch type dryers, and provide the best alternate for heat reclamation when drying and cooling are not occurring at the same time. However, heat exchangers are significantly more expensive than recirculation systems. A number of design factors are given for avoiding potential design errors. 6 refs., 8 figs., 1 tab.

19820 **(OAEC—8802) Heat recovery from milk cooling systems.** Winfield, R.G. (Ontario Agriculture Energy Centre, Guelph (Canada)). 1988. 4p. (CE—02312). Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, Ont., Canada N1H 6N1; $N/C.

On dairy farms, milk must be cooled to maintain milk quality. Heat energy removed during cooling can be recovered and used in a number of cost-effective ways as outlined in this report. Methods are presented for estimating hot water usage and for calculating potential energy savings from displacement of purchased energy for water heating. Basic types of heat recovery systems are described, including total water-cooled condensing systems that put all of milk heat into preheating water, add-on recovery units for connection to air-cooled systems, and precoolers that permit milk to be partially cooled by water prior to entering the bulk milk tank. Some examples are given to show possible energy and cost savings. 2 refs., 5 figs., 1 tab.

19821 **(OAEC—8806) Gravity manure transfer systems for dairy barns.** Slater, G.; Turnbull, J.E. (Ontario Agriculture Energy Centre, Guelph (Canada)). 1988. 4p. (CE—02308). Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, Ont., Canada N1H 6N1; $N/C.

Transferring manure from dairy barns to long-term storage can be done by gravity flow, rather than by mechanical equipment. This method of transfer is simple, effective, and less expensive, and is of increasing interest to Canadian farmers. This paper discusses the recent experience of Ontario dairy farmers with gravity flow manure transfer systems, and describes the factors that have to be taken into account when choosing and installing such a system. Two basic types of systems are highlighted: the minimum grade, continuous-flow system, and the steep grade, flush system. General recommendations are made concerning barn drainage, management of bedding and other solid materials, maintaining manure at the proper consistency, long-term storage, and safety. To date, experience indicates these systems work satisfactorily. 7 figs.

19822 **(SRC—NO131) Farm energy management program. Year 1 report.** Gimby, M.; Jensen, N.E.; Gamble, W.; Boerma, H.; Coxworth, E.; Valby, J.; Lindskog, R. (Saskatchewan Research Council, Saskatoon (Canada)). 1982. 165p. (CE—02380). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the beginning stages of a farm energy management study of 21 farms located throughout Saskatchewan. A description of each farm is given, and data are presented about energy use (fuel, electricity, fertilizer) in terms of where it is used (farm operations, transportation, domestic use) and how energy costs relate to total costs. Projections are made as to what energy costs might be if no energy conservation measures had been undertaken. Some preliminary recommendations about energy conservation strategies have been made for each farm. The results of an analysis of the data show potential for energy savings in several areas, with significant cost savings potentials existing on most of the farms studied. The major areas may be categorized into the following groups. Transportation appeared to offer considerable potential for significant energy savings in a short period of time for a large number of the farms. In cropping practices, energy savings appear possible in fertilizer use, crop rotation, and moisture management, but many of these practices would require small-scale testing and several years of evaluation before they could have a substantial impact. Ancillary practices on certain farms offer unique conservation opportunities; these include grain handling, drying and storage, and manure storage and utilization. In farm buildings, significant conservation potential exists in the area of insulation improvement and use of heat exchangers. Some fuel energy savings are possible through optimal operation of farm machinery. 27 refs., 24 refs., 7 tabs.

19823 **(STU—82-5705) Feeder appliances.** Gustavsson, C. (Svenska Gjuterifoereningen, Joenkoeping (SE)). (Swedish National Board for Technical Development, Stockholm). 28 Feb 1986. 113p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757081/JAW.

When producing castings the yield is an important question concerning economy as well as energy consumption. Thus a maximum yield is always desirable. A way to obtain an increased efficiency is to reduce the feeder size. This can be done with different feeder facilities. The most common is to enclose the feeder with an exothermic and/or an insulating envelope. Also the upper surface of the feeder ought to be covered with such a material. The positive effects obtained by use of such facilities are: * Increase of productivity due to the fact that more flasks can be moulded with the same amount of iron and a higher possible utilizing of brims. * Energy consumption is reduced when less material is circulated and remelted in the foundry. * More flexible production, i.e. teeming temperature, solidification speed, size of feeders etc. are of less importance for the quality. * Cleaning work is reduced by smaller connecting feeder and even fewer feeders. * Cassation level is reduced by simplification and standardization of quality affected preparation work. (L.F.).

19824 **(STU—84-3365) Computer-aided dimensioning and control of fluidized bed metallurgical furnaces.** Zethraeus, B. (Swedish National Board for Technical Development, Stockholm). 11 Sep 1986. 124p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757083/JAW.

The report comprises mainly studies of fluidized beds for heating and/or heat treatment of metallic goods. From this basis a simulating programme has been developed which enables calculations of production and energy consumption by heating goods in FB-ovens. By comparison with laboratory tests the programme has shown fully acceptable results. By introduction of FB-ovens in Swedish workshop industry is it not only necessary for the units to be correctly dimensioned but also to be properly controlled. Within the project then a number of simple equations have been developed which may be a base for computerized process controlling systems. Together the two models constitute dimensioning as well as controlling base when FB-ovens are used. (L.F.).

19825 **(STU—84-5321) Energy saving glass furnace for open crucibles.** Rasmusson, S. (SEA Glasbruk AB, Kosta (SE)). (Swedish National Board for Technical Development, Stockholm). 17 Dec 1986. 8p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757084/JAW.

The purpose of this report is to minimize costs for melting glass in a crucible furnace, to improve interior and exterior envi-

ronment, to arrange for simpler exchange of crucibles and for a speedy and simple installation and repair. An electrically heated furnace has been developed which consumes 40% less energy than an oil fired furnace. Practically no discharge to the exterior environment occurs and the furnace is silent compared with 80-85dBA for an oil fired furnace. It is bell shaped and built of high quality insulation material and encased by refractory material. The bell is liftable at change of crucible and the crucible is easily handled with a lifting device. The heating time for the furnace is less than 24 hours. (L.F.).

19826 **(SV—2000-87-1259) Activity report of step 1 and Proposal of activity plans for step 2 within Project 2000 - Industry.** Eklund, S.A. (Swedish State Power Board, Vaellingby). 22 Dec 1987. 65p. (In Swedish). NTIS (US Sales Only), PC A04. Order Number DE88757090/JAW.

During step 1, 1986-1987, the project's industrial sector was limited to small and medium sized businesses of industry which is about the same as the non-electricity intense industry. This sector consumed in 1984, a year that was suitable from climate and trade conditions point of view, c. 11.6 TWh electricity. All industry consumed 44 TWh that year. Energy consumption divided into electricity and fuels, was studied theoretically and divided into 10 production processes and 5 installation processes. This is novel and has not been done before. The theoretical electricity conservation potential was estimated to 1.5 - 2 TWh for unchanged production make-up and volume, and by future energy prices. Energy mapping, both simple surveys and more extensive measurements and analyses, in totally c. 53 enterprises indicates an energy conservation potential by future energy prices of c. 10-20% compared to todays electricity consumption. During step 2 it is suggested that also the big industry, the electricity intense industry will be studied. Furthermore the activities will be directed towards testing of different measures by the ultimate consumers. Definite extent of step 2 will be planned during spring 1988 and result in an activity plan, including scope, schedules, and costs. (O.S.).

19827 **(SV-UP—1987-53) Energy efficiency at AB Gustavsberg pottery industry. Stage 2.** Fors, J. (Teknikgruppen AB, Stockholm (SE)). (Swedish State Power Board, Vaellingby). 30 Apr 1987. 45p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757100/JAW.

The project began in 1984 with a survey of how energy was used in the different plants. In the winter of 1985/86 a first stage of an 'Energy Savings project' was carried out. The results of this work was an annual saving worth SEK 816 000, with a pay-off-time of 1.2 years. This report summarizes the results of a second stage of the Energy Savings project that was carried out in the winter of 1986/87. The goal was to achieve energy savings equivalent to SEK 275 000 in the Tableware factory, SEK 240 000 in the Sanityware factory, and SEK 70 000 in the Bathtub factory. The conditions of the production at the two former of these factories changed considerably between the two stages of the project (new furnaces were installed, production decreased). This made it impossible to calculate savings (in the meaning of decreased energy consumption at approximately unchanged production) from the actions taken. For the Bathtub factory, however, it was possible to calculate the savings. They were SEK 50 000 in water consumption and SEK 70 000 in heat consumption, well ahead of the goal mentioned above. The total pay-off-time since the start of the project in 1984 is now 1.7 years.

19828 **(TNO-VI-T—87/021) Wet-on-wet and minimum application techniques.** Sulsters, A.A. (Nijverheidsorganisatie TNO, Delft (Netherlands). Fibre Research Inst.). Sep 1987. 68p. (In Dutch). Vezelinstituut TNO, P.O. Box 110, 2600 AC Delft, Netherlands.

An overview is given of different methods in the textile industry to put small quantities of solution on dry and wet cloth taking into account the technical possibilities for application, the phase in which the processing can be applied, the potential energy conservation and the payback period. Also application problems are indicated. The overview can be used to stimulate the applicability of these energy conservation techniques in the industry and to give direction to required research. 2 figs., 5 tabs., 20 apps.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 19449, 19459, 19752, 19770, 19772, 19899, 19929, 20322

19829 **(BFR-R—78-1988) Signal analysis for design rating of heat stores in energy systems. A case study in Aengelholm.** Larsson, P.O. (Viak AB, Malmoe (SE)). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). Apr 1988. 39p. (In Swedish). NTIS (US Sales Only), PC A03. Order Number DE88757035/JAW.

The report investigates the feasibility of using signal analysis as an aid to establishing the rating of a heat store in a heating system. A case study has been carried out on the district heating system in Aengelholm in order to investigate the applicability of the method. Results from the use of various sub-programs in the group of programs are presented in tables and figures. An analysis of the applicability of the signal analysis method has been made, and complementary manual calculation methods are described. Further development work is needed in order to complete the group of programs and to bring them to the stage where they can be used to perform design rating analyses of complex energy systems without requiring manual calculations.

19830 **(CONF-871058—1) Low-cost sensors for the gas industry.** Ziolkowski, C.J. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 18p. OSTI - Institure of Gas Technology, 3434 South State Street, Chicago, IL 60616. Order Number TI89007175/JAW.

From Integrating microelectronics into gas distribution; Minneapolis, MN, USA (26 Oct 1987).

Automation of gas industry operations requires the sensing of many physical quantities coupled with the use of distributed intelligence. Cost-efficient automation requires very low-cost sensors. The use of microprocessors in automation presents an opportunity to make use of the repeatability of a sensor rather than accuracy. The recognition of the needs and opportunities in advanced gas distribution prompted the Gas Research Institute to sponsor this project on low-cost sensors.

19831 **(CONF-880521—7) Biogasification of community-derived biomass and solid wastes in a pilot-scale SOLCON reactor.** Srivastava, V.J.; Biljetina, R.; Isaacson, H.R.; Hayes, T.D. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 23p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007161/JAW.

From 10. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (16 May 1988).

The Institute of Gas Technology has developed a novel, solids- concentrating (SOLCON) bioreactor to convert a variety of individual or mixed feedstocks (biomass and wastes) to methane at higher rates and efficiencies than those obtained from conventional high-rate anaerobic digesters. The biogasification studies are being conducted in a pilot-scale experimental test unit (ETU) located in the Walt Disney World Resort Complex, Orlando, Florida. This paper describes the ETU facility, the logistics of feedstock integration, the SOLCON reactor design and operating techniques, and the results obtained during 4 years of stable, uninterrupted operation with different feedstocks. The SOLCON reactor consistently outperformed the conventional stirred-tank reactor by 20% to 50%.

19832 **(DOE/CE/39844—H1) Who's who in energy recovery from waste.** (Science Applications International Corp., Alexandria, VA (USA)). Feb 1989. Contract AC01-86CE39844. 33p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007702/JAW.

"Who's Who in Energy Recovery from Waste" is a directory of organizations and individuals that are actively involved in the energy from municipal waste field. The purpose of this directory is to facilitate technology and information transfer within the industry and to provide a resource for those communities that are developing or considering municipal waste-to-energy projects.

19833 **(DOE/CH/10218—3) Institutional Conservation Programs manual.** (B and M Technological Services, Inc., Cambridge, MA (USA)). Mar 1987. Contract AC02-84CH10218. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007708/JAW.

This manual has been developed to provide an overview of the United States Department of Energy's Institutional Conservation Programs (ICP). It is intended for the use of federal employees, State Energy Office personnel, institutional managers, and others interested in the general operational elements of the Institutional Conservation Program and the regulations which govern it. The role which this document will play could vary from entity to entity, and its overall use will be at the discretion of each individual United States Department of Energy Support Office. The Institutional Conservation Program (ICP) is one of the major energy conservation programs of the US Department of Energy. The Program is a matching grant program which provides funds to schools, hospitals and certain other public or nonprofit institutions for the purpose of initiating a methodology for assessing building energy use, and identifying and implementing energy efficiency improvements. 2 tabs.

19834 **(NBMAE—88) Solid waste management in New Brunswick.** (Department of Municipal Affairs and Environment, Fredricton, New Brunswick (Canada)). [1988]. 14p. (In French). (CE—02086). New Brunswick. Dept. of Municipal Affairs and the Environment, Centennial Bldg., PO Box 6000, Fredericton, NB, Canada E3B 5H1; $N/C.

Expansion of towns and cities, increased levels of waste generation, greater environmental awareness, and lack of landfill sites have brought about a critical evaluation of the problem of solid wastes in New Brunswick. A regional approach to waste management has been identified as the optimum long term solution. This involves establishment of regional commissions in 12 to 15 regions to be defined throughout the province. Funding will be supplied in cooperation with the provincial government, which is to develop an overall plan for provincial waste management. The planning process involves public information and consultation, evaluation of solid waste management options, identification of possible sites for waste management facilities, and environmental impact assessments. Possible management options include recycling, composting of the organic portion of the waste, incineration (with possible energy reovery), and sanitary landfilling. The first regional commission has been established in the Fredericton area and has been operating a new, sophisticated sanitary landfill system since July 1986. 17 figs.

19835 **(NEI-SE—34) Model for analysis of electric load demand in Sweden.** (Swedish State Power Board, Vaellingby). 2 Sep 1986. 34p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757057/JAW.

This report is the first part of a project, whose purpose is to develop models for electric load forecasts. The purpose of this paper is to develop a model for analysis of short-term variations in electric load demand. The model should, partly, explain the relationship between the load demand and some driving variables, such as the outdoor temperature and the volume of industrial production, and partly, illustrate the seasonal effects. The model is a linear multiple regression model which is estimated by the method of ordinary least squares and by the two-step full transform method. The study covers the years 1978 to 1984. The load-situation consists of the aggregated hourly load values of 11 utilities in Sweden. The basic assumption is that the electricity demand can be divided into three parts: the temperature-dependent load, the industrial production-dependent load and the remainder, baseload. The meteorological data consists of measurements of hourly temperature in 15 different places in the country. The effective temperature is then defined as a lag-function of the observed temperatures. The industrial production consists of the monthly index numbers of mining and manufacturing. The goodness of fit is for the weekday-model 0.95 and for the weekends-model 0.92.

19836 **(NP—9770289) Development of a method for the detection of heavy metal discharges into the sewer system. Final report.** Gutekunst, B. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1988. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770289/JAW.

Very often the agricultural use of municipal sludges is inhibited due to heavy metals contents, that exceed the values of the municipal sludge decree (Klaerschlammverordnung). This sludge contamination can only be reduced, if heavy metal containing run-offs are avoided. An effective method for registration and control of the waste water run-offs is therefore necessary. The analysis of sewer slime, a biofilm, that grows on the inner surface of waste water canals is a successful method to localize heavy metal laden run-offs. In this paper the results of the biological and the chemical analysis of several sewer slimes of different origins are presented. The accumulation of Cd, Cu, Ni, Pb and Zn in sewer slimes at different chemical conditions (pH, metal and slime concentrations) is investigated. The accumulation rate may reach 90%. The affinity of the slime towards metals decreases in the following way: Pb>Cu>Cd>Zn>Ni. The attachment of the metals on the biomass is mostly irreversible. Sequentional leaching shows that more than 70% of the Cd, Cu and Pb is tightly bound. Ni and Zn also appear in more soluble species. The remobilization of heavy metals is possible at acid conditions and in the presence of chelating agents. The growth of the biofilm depends on the nutrient content of the waste water and its flow rate. (orig.) With 42 refs., 15 tabs., 18 figs.

19837 (STU--85-5404, pp 89-95) **Corrosion experiments in burning of municipal waste.** Forsen, O.; Ylaesaari, S. (Helsinki Univ. of Tech., Espoo (FI). Laboratory of Corrosion Science and Applied Electrochemistry). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The aim of this paper is to investigate the corrosion risks in burning of pre-treated municipal waste as additional fuel together with bark in a fluidized-bed boiler. It was deduced that the burning of bark alone did not cause corrosion in the materials tested. When the waste was burnt the corrosion of steels was insignificant when providing that the surface temperature of material was below 300 deg C. The burning of municipal waste caused corrosion in the conventional boiler steel. The stainless steels were not corroded even in these conditions. (authors).

19838 **(SV—2000-87-1311) Project 2000. Behavioural scientific aspects of energy consumption The human factor - Activity report of step 1.** Levin Kruse, K. (Swedish State Power Board, Vaellingby). 30 Dec 1987. 72p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757091/JAW.

The report describes aims, planning and results of the behavioural scientific parts of Project 2000 in step 1. Proposal for step 2 is included. Investigations of the importance of the consumers in energy topics in dwellings, premises and industries are reviewed and evaluated. Moreover, the contact paths of the State Power Board towards consumers are surveyed. Activities in knowledge transfer from Project 2000 to other sections of the State Power Board are described as well. (O.S.).

19839 **(SWAC—8805) Development of the Special Waste Program for British Columbia. Towards a healthier environment.** (Special Waste Advisory Committee, Vancouver, BC (Canada)). 1988. 44p. (MICROLOG—88-04952). British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A special advisory commitee was appointed to review options for a comprehensive special waste management system for British Columbia. Special wastes are those which are harmful to

health or the environment if not treated in special ways, and can include used oils and solvents, acids and bases from petroleum and chemical companies, and sludges from manufacturing facilities. In reviewing the options, the committee considered waste streams, waste volumes, economic development of the province, existing waste services, and the degree of provincial commitment to special waste options. Public participation was achieved through information campaigns, meetings, and open houses. Following a search and review process and assessment of proposals, a group of companies was selected as a joint venture to construct and operate the special waste management system. A site selection process involving visits to potential host communities, and meetings with those to be affected, was also carried out. Recommendation was made to continue the site selection process in the Ashcroft-Cache Creek area, where public acceptance has been indicated and where geologic and climatic conditions appear favorable.

19840 **(TNO-HMT—87-299) Practical experiment at energy conservation in cooling systems equipped with wet evaporators.** Van Gerwen, R.J. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Oct 1987. 40p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, P.O. Box 342, 7300 AH Apeldoorn, Netherlands.

As a result of the MT-TNO (Division of Technology for Society of the Netherlands Organization for Applied Scientific Research) executed research on skating rinks (1985-1986) a concept has been developed for an alternative design of cooling systems equipped with wet evaporators known here as flashgas application or applying of flashgas. The backgrounds of this concept are discussed. The cooling system of the ice rink 'De Vechtsebanen', Utrecht, Netherlands, offered the possibility to demonstrate the positive effect of flashgas application by means of a practical experiment. In the summer of 1986 the cooling system was adjusted for that purpose and measurement facilities were installed. During the skating season 1986-1987 measurements were carried out of which the results are discussed. It is concluded that the improvements of the cooling system do not meet the expectations. 19 figs., 10 refs., 2 tabs.

19841 **(USAID/OE—9008470) Prospects in developing countries for energy from urban solid wastes: Bioenergy systems report.** (Agency for International Development, Washington, DC (USA). Office of Energy). Sep 1988. 25p. OSTI - U.S. Agency for International Development, Office of Energy, Washington, DC 20523. Order Number TI89008470/JAW.

This report has been designed to provide (a) a comparative analysis of the characteristics of urban solid wastes in the US, Europe, and developing countries; (b) basic information on the characteristics and operation of the principal types of waste-to-energy systems in use in the US and Europe at present; and (c) a preliminary assessment of the feasibility of using each type of system with wastes available in developing countries. The feasibility of a waste-to-energy option in a given city in a developing country is greatly influenced by the waste collection, scavenging, and waste disposal practices in that city and by the composition of the residual wastes. Although the details vary considerably from city to city, the following generalizations apply to the great majority of cities in developing countries.

19842 **Advanced energy transmission fluids for heating and cooling systems.** Kasza, K.E.; Choi, S.U.; Kaminsky, J. (Experimental Thermal Hydraulics Section, Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL (US); Buildings and Community Energy Systems, USDOE, Washington, DC (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1703-1716(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-15-5.

The U.S. Department of Energy (DOE) is sponsoring a comprehensive program to develop high-performance energy transmission fluids for use in district heating and cooling (DHC) systems. These fluids would substantially reduce flow frictional losses and enhance heat transfer. In system enhancement scoping studies, the fluids have been shown to yield potentially significant upfront capital equipment cost reductions by allowing the use of smaller pipes, pumps, heat exchangers, and storage tanks as well as reductions in operational costs.

19843 **The feasibility and economics of slush ice district cooling systems.** Metz, P.; Margen, P. (Brookhaven National Lab., Bldg. 120, Upton, NY (US); District Energy Systems, Allheigonavagen 21, 611 35 Nykoping (SE)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1672-1686(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-15-3.

District cooling systems offer advantages over individual building systems by allowing the selection of central sites close to rivers or other low summer temperature heat sinks, sites close to open spaces for cool storage, and the advantage of reducing specific chiller and cool storage costs by economy of scale. These advantages are obtained at the penalty of the cost of an additional distribution system. This paper examines the technology status of slush ice district cooling systems. Then, using the BNL District Heating and Cooling (DHC) Technology Characterization Computer Model with delivered energy cost as the figure of merit, a wide range of central and individual building cooling systems are compared. Slush ice district systems are found to be most competitive with sharply-peaked cooling loads, premium piping installation costs, premium storage cost, and high on-peak electric rates. Research and development needs include an efficient low-cost reliable ice-making evaporator, an efficient heat-activated ice-making chiller, greater slush ice storage experience, and flow research -- particularly concerning frictional factors and segregation behavior.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 19709, 19748, 19756, 19757, 19763, 19764

19844 **(DOE/CE/26509—T1) Regional technology transfer workshops: Final report.** (Public Technology, Inc., Washington, DC (USA)). Jan 1988. Contract FG02-84CE26509. 117p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008106/JAW.

In early 1985, the Energy Task Force Management Corporation, acting on behalf of the Urban Consortium Energy Task Force, began preparations for a series of Regional Technology Transfer Workshops to spread the energy management expertise and experience developed through the Task Force program to staff of cities and counties throughout the United States. Initially intended as an effort to support a total of four workshops, co-sponsorship agreements allowed the conduct of six regional workshops. Workshops were designed to address topics for which substantial experience existed within city and county staff of the Energy Task Force, and for which significant interest was perceived from staff in other jurisdictions. Initial workshop sites were selected as Baltimore, Maryland; Kansas City, Missouri; San Francisco, California; and Austin, Texas. Subsequent to this selection of initial sites, two additional workshops were added, one in Atlanta, Georgia; the second in Columbus, Ohio. All six workshops were conducted during the period from May through November, 1985. This report describes the preparation process, topics and results from each workshop. Appendices include the Workshop Preparation Manual used as the initial model for the workshops, as well as detailed materials that cover publicity, assistance providers and topics for each workshop.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

19845 **(VTT-TIED—907) Operation of vehicle engines in cold conditions: start up, lubrication and fuel consumption.** Nylund, N.-O.; Kytoe, M.; Laurikko, J. (Secretaria de Asentamientos Humanos y Obras Publicas, Mexico City (Mexico)). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Nov 1988. 54p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757111/JAW.

Studied were the fuel consumption and wear of engines in cold conditions. The type of lubricant (mineral, semisynthetic or synthetic oil) affects start-up and start of lubrication. The fuel consumption depends mainly on temperature, type of engine, driving manner and viscosity of lubricant. Test were carried out with three gasoline engines and two diesel engines in a special cold research room. The test engines were put under load by an engine dynamometer. On one of the gasoline engines, tests were also made with a manual transaxle. The start of lubrication and the fuel consumption were determined by 30-minute engine tests with different lubricants at the temperature range of +20--30 deg C. The engines were run both under constant load and cyclic load. The effect of electric preheaters (block and oil heaters) was also studied. Although the viscosity class of all the test oils was SAE 10W30 or SAE 10W40, the time required for the rise of the oil pressure on the most remote bearing of the camshaft decreased even by 50% at low temperatures when using synthetic oil instead of mineral oil. Compared to the mineral oil the synthetic oil gave easier startability, although the rotating speed in start-up was the the same with both oils. The compression pressure was higher and the friction lower when using synthetic oil. The start-up was considerably easier when an electric block heater was used. As the block heater does not warm up the oil in the oil sump, the cold viscosity of the oil must be sufficiently low. The fuel consumption in a 30-minute test increased by 4-9% in diesel engines and by 5-22% in gasoline engines, when the test temperature was lowered from +20 deg C to -25 deg C. The type of the oil did not affect significantly the fuel consumption, though compared to the mineral oil the synthetic oil clearly decreased friction loss in the gearbox.

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 19178, 19550, 19786, 19800, 19803, 19859, 19861, 19861, 19862

19846 (CONF-8711230—, pp 121-170) **Diesel fuel composition and emissions.** Gairing, M. (Daimler-Benz A.G., Stuttgart (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

Diesel fuel must be of equal quality to the diesel engine. An overview given in this article goes into detail on: - ignition properties, boiling curve, sulphur content, temperature behaviour, density, viscosity, flashpoint, purity, stability, foaming properties and corrosion protection. A further boost in quality for diesel fuel and the introduction of a seal of quality are considered necessary. Experiments and results from a passenger car prechamber combustion engine, and more recent experiments on a commercial vehicle diesel engine are discussed. The influence of an ignition accelerator on emissions and the influence of ignitability on cold starting were also studied. At the end, conclusions from a large number of experiments are drawn up under 9 points and corresponding recommendations are given for fuel quality. (HWJ).

19847 **(CRIE-W—87022) Development of ceramic fiber combustor of gas turbines: basic structure of combustor and preliminary test results.** Hisamatsu, Toru; Abe, Toshio. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1988. 21p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756473/JAW.

Ceramic gas turbines are being developed for improved efficiency of combined cycle power generation. A trial unit of ceramic fiber type 20 MW class combustor was constructed and tested. Woven fabric of SiC fibers in 35 layers (thickness: 10 mm) was sewed and fastened with SiC threads. Stable combustion was demonstrated in a normal pressure combustion test. Seep-out cooling with high efficiency was observed. The temperature of metal wall was equal to inlet air temperature and uniformly distributed. An equation was established for pressure drop of cooling air flow. The pattern factor of outlet gas temperature distribution was similar to those of existing combustors. A part of uppermost layer of fibers on the combustion gas side was separated in the test for 9h, including quick fuel interruption at high loads since the SiC fibers become brittle at temperature exceeding 1000°C. The applicability of ceramic fibers to combustor lining is expected to be high when fibers with high durability at high temperature is used or manufacturing and fastening method of fiber layers are improved. (13 figs, 2 tabs, 3 refs)

19848 **(DE—8603) Reduction of the fuel economy penalty associated with the operation of road vehicles at low ambient temperatures. Final report.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). 1986. 140p. (CE—02391). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A testing program was conducted to evaluate specific vehicle modifications for fuel consumption at low ambient temperatures. The following modifications were tested and compared using two 1984 Chevrolet Cavaliers: intake manifold preheat and heating; intake manifold insulation; transmission oil preheat and bypass; and combination of above modifications. Fuel consumption measurements were made at +20/sup 0/C, 0/sup 0/C and -20/sup 0/C by performing testing on the vehicles over the road and on a chassis dynamometer in an environmental chamber. The testing has revealed that substantial savings in fuel consumption for a vehicle operating at low ambient temperatures can be realized it the appropriate modifications are installed on the vehicle. The modification that has shown the best reduction in fuel consumption was the transmission oil preheat and bypass system. The reduction in fuel consumption for this modification was 24% for one of the vehicles for when compared to the base configuration over the first 4.1 km for the on-road testing. A combination of the intake manifold preheat, heating and the transmission oil preheat and bypass produced a fuel consumption reduction of 25% when compared to the base configuration. Slightly lower fuel consumption reductions were realized during the dynamometer testing. The largest reduction in fuel consumption recorded during the cold start and warmup segment was 7.7% for the intake manifold preheat, heating, insulation and transmission oil preheat and bypass modification, when compared to the base vehicle. 2 refs., 37 figs., 24 tabs.

19849 **(LRAP—89) Study of inductive and capacitive ignition and kernel development.** Carlsson, R.; Johnsson, B. (Lund Univ. (Sweden). Dept. of Physics). 1988. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757054/JAW.

One way of improving the performance of an internal combustion engine is to improve the ignition. The aim of this study was to investigate how the flame speed in a burning gas is influenced by the electrical properties of the spark. This was done by recording the voltage, current and flame front of single sparks and comparing them individually and statistically. Two different ignition systems were used, one based on an inductive discharge and one on a capacitive discharge. The explosive gas was a mixture of propane and air, just above stoichiometry. The measurements were performed at atmospheric pressure and at 4 bar. Two different types of spark plugs were used: one with steel electrodes and one with copper electrodes. (authors).

19850 **(ORNL—6513) Influence of diesel engine combustion on the rupture strength of partially stabilized zirconia.** Brinkman, C.R.; Begun, G.M.; Cavin, O.B.; Foster, B.E.; Graves, R.L.; Kahl, W.K.; Liu, K.C.; Simpson, W.A. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 73p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007897/JAW.

Results are reported for tests on partially stabilized zirconia (PSZ-TS and MS grades) bars exposed in the combustion chambers of two operating single- and two-cylinder 0.825-L diesel engines. The specifics of test conditions and procedures are presented. Subsequent to exposure, the bars were subjected to four-point bending, and the rupture strengths were determined. The TS grade showed a decrease in average strength of 32%, whereas the strength of the MS grade decreased by about 9% in comparison to average behavior of unaged material. Results of x-ray diffraction analysis, Raman spectroscopy, isothermal aging studies, and ceramographic characterization are given to define reasons for material degradation. 9 refs., 15 figs., 2 tabs.

19851 **(ORNL/Sub—87-07685/1) Fuel nitrogen conversion in a spark ignition engine: Part 2, Effects of fuel/air mixture preparation.** Hodgson, J.W. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering). Feb 1989. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007908/JAW.

A study has been completed in which a single-cylinder engine was operated on iso-octane and iso-octane doped with a nitrogen compound (pyridine). Tests were conducted to investigate the effects of fuel-air mixing and spark advance on the conversion of the fuel-bound nitrogen to nitric oxide. The results of the present study are compared with those from previous studies and it is concluded that both fuel-air mixing and spark advance affect the amount of fuel-bound nitrogen that is converted to nitric oxide. The results of the present study also can be used to explain the discrepancies that had existed among three previous studies dealing with fuel nitrogen conversion in spark ignition engines. 8 refs., 16 figs.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 19788

19852 **(AD-A—201141/9/XAB) Assessment of the Philips USFA BV 7MM cooling engine.** Laycock, D.P.; Powell, W.J. (Royal Signals and Radar Establishment, Malvern (UK)). May 1988. 45p. (RSRE—87018). NTIS, PC A03/MF A01.

Philips Usfa B.V. Stirling-cycle split-mode cooling engines, sampled from development, pre-production batches, have been extensively tested at RSRE. Measurement of cryogenic performance at normal and high ambient temperatures in run-stop-run and continual-run regimes were made. Representative detector encapsulations were interfaced to provide typical combination heat loads. One pre-production unit was installed and operated successfully in a Thermal Imaging Common Module (TICM) Class 2 Scanner. Detector microphony-noise measurements were made and compared with those recorded when the same array was cooled with high-pressure pure gas liquified by a Hymatic self-regulating mini-cooler. Initial problems of contamination of the helium gas and of the thermal interface with the detector encapsulation were highlighted and addressed by the manufacturers. A production standard unit has achieved over 5,000 hours intermittent and continuous running during a period of 12 months.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 19658

3304 Hybrid Systems

19853 **(NP—9770287) Refuse collection vehicle with energy-economic engine. Special information on preliminary development.** (M.A.N. Nutzfahrzeuge G.m.b.H., Muenchen (Germany, F.R.)). [1988]. 5p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770287/JAW.

As refuse collection vehicles work on a constant stop-and-go basis, an engine system using brake energy recovery was considered promising. The kinetic energy of the vehicle is transformed and stored during braking. During the subsequent working period, the stored energy is used to feed the hydraulics for the superstructure by means of a hydro-unit in engine operation. The integration of the hydraulic components into the existing vehicle design is comparatively easy because the working hydraulic system is already there. The author gives an overview of structural, functional and performance features of a local authority vehicle developed specially against this background, of which the major element is a brake energy accumulator. Circuit diagrams and tables are used to summarise information. The results published come from research studies (fuel consumption, energy account of a braking operation). (HWJ).

3306 Vehicle Design Factors

19854 **(NP—9770286) Camera-controlled vehicles as a step towards the 'smart car'. Documentation.** (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 29 Apr 1988. 17p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770286/JAW.

Some parts of the processes involved in running a motor vehicle are increasingly automated, it is true, but the car still cannot see, and thus is unable to move on its own. The ideal guiding system would be independent of extra equipment along the side of the route. After preliminary experiments with multi-microprocessor-systems for image pre-processing (TV camera signals) and matching computer programms, an 'experimental vehicle for autonomous mobility and computer vision' (VaMoRs). It has an on-board electricity supply, 3 computer-controllable articulations for steering, fuel supply (acceleration) and brakes. Trial runs at up to 100 km/h demonstrated the feasibility of the system. The report gives details of the vision system and assesses it by comparison to similar ones from Japan and the USA. (HWJ).

19855 **(SU/ME—8410) The design, construction, and evaluation of a 1 l/100 km personal commuter vehicle prototype. Phase 1, design of Nexus vehicle.** Gerwing, D.H.; Hertz, P.B. (Saskatchewan Univ., Saskatoon (Canada). Dept. of Mechanical Engineering). 1984. 429p. (CE—02398). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the design of Nexus, an efficient and safe single-passenger commuter vehicle with a fuel consumption goal of 1 l/100 km at modest highway speeds. Based on a detailed survey of other designs and on compliance with Canadian standards, a configuration embodying a mid-engine powered rear wheel and two outrigger, steering, front wheels was selected. The supermileage principles of low vehicle resistance and high propulsive efficiency were applied in all aspects of the design. Wind tunnel modelling led to an advanced aerodynamic body shape which exhibited negative drag at low yaw angles and a wind-averaged drag coefficient of only 0.18. The performance of the protective frame and energy-absorbing nose were finite element analyzed to satisfy structural safety standards. A low curb weight of 550 lb was projected. The efficiency characteristics of four potential motorcycle-type power trains were mapped in various states of tune utilizing computer-monitored dynamometer test cells. This enabled the fuel economy and performance of Nexus to be calculated and simulated under various driving cycles with Transport Canada's VEHSIM computer program. The Nexus design was shown to be capable of steady state fuel consumption minimums ranging from 0.65 l/100 km with the smallest 70 cc power train to 1.36 l/100 km with the largest 250 cc engine simulation. Good promise of compliance with the intent of the safety standards was also indicated. Extensive utilization of the Nexus-type of vehicle could reduce Canadian transport energy consumption by up to 30 percent. 34 refs., 95 figs., 37 tabs.

19856 **(SU/ME—8605) The design, construction, and evaluation of a 1 l/100 km personal commuter vehicle prototype. Phase 2, construction of Nexus vehicle.** Gerwin, D.H.; McEachern, R.A.; Schultz, G.J.; Beaudry, D.L.; Watson, L.G.; Hertz, P.B. (Saskatchewan Univ., Saskatoon (Canada). Dept. of Mechanical Engineering). 1986. 157p. (CE—02051). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the construction phase in the development of an extremely fuel efficient single-passenger vehicle called Nexus. A preliminary prototype design was taken through detailed design iterations and manufactured. Revisions and constraints placed on the initial design by time, budget, manpower, and availability of components, necessitated some measure of compromise in this first demonstration Nexus prototype. Except for the conventional 25 cc power train, most of the chassis components required either extensive modification or total development and fabrication from scratch. The highly streamlined composite body and wheel fairings are now projected to exhibit a wind mean drag coefficient of only 0.186 with a resistance factor of 0.172 m/sup 2/. This aerodynamic advantage, together with a low vehicle curb weight of 650 lb, should permit steady state fuel economies in the range of 1.5 l/100 km. The high strength aluminum frame, with integral wraparound bumper and olyurethane foam nose, show good crash-worthiness potential. The substantial array of passenger car safety features, together with remarkable handling and maneuvrerability, indicate that this first Nexus prototype will be capable of demonstrating a viable future personal transportation concept that is both safety compliant and very energy efficient. 23 refs., 57 figs., 12 tabs.

19857 **(TC/RS—8503) A test program to determine the benefits of a crank clutch and two speed accessory drive system on a typical North American passenger car.** (Transport Canada, Ottawa, Ontario. Road Safety). 1985. 176p. (CE—02395). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In the search for ways to improve the energy efficiency of automobile engines, one method that has been investigated is the declutching of various engine accessories during those periods of engine operation when the accessory is not required. Two systems of declutching or partially loading the total engine accessory package, the crank clutch and the two-speed accessory drive, are examined in this study. The study objectives were to determine the benefits of these systems on a typical North American passenger car. A series of tests was devised to evaluate the overall performance of the vehicle under various conditions. Tests were performed with the accessory package in full ratio, one-half ratio, one-third ratio and the declutched mode so that a comparative evaluation could be obtained. The tests performed were cold start performance, acceleration performance, EPA fuel economy, and constant-speed fuel economy. Also, the individual accessory torques were determined in order to provide insight into the relationship between the amount of fuel saved to the reduced load on the engine and design criteria of crank clutches and two-speed accessory drive units. Results of this investigation indicate a definite improvement in cold start and acceleration performance with the accessories declutched or driven at reduced speed. EPA and constant-speed fuel economy were also improved with the reduced accessory speeds. Disadvantages of the system included lack of coolant circulation, and lack of power steering, during the declutched mode. These disadvantages could be eliminated if onboard computers currently becoming available are incorporated into the system. 31 figs., 22 tabs.

3307 Emission Control

REFER ALSO TO CITATION(S) 19863

19858 (CONF-8711230—, pp 49-63) **Legal regulations governing fuel and exhaust specifications in Europe.** Becker, R.F. (Mobil Oil A.G., Wedel (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

Illustrated with extensive details in tabular form, an overview is given of Otto and diesel fuels, their properties and the legal requirements concerning them; and also of the history of exhaust legislation in Europe. Individual details discussed relate to octane levels (EC lead directives, norms, minimum requirements); lead content (maximum, tax incentives), benzole (restriction to 5%) oxygen-containing components (oxygenate directives, addition of methanol, ethanol, MTBE) and sulphur content (diesel fuel, distillation limits). Individual details from the major emission guidelines are also stated. They concern gaseous emissions from vehicles with petrol-driven engines (now extended to include diesel engined passenger cars); smoke emissions from diesel-powered vehicles; gaseous emissions from diesel-powered lorries (trucks) (a further tightening of this ECE 49 standard is already anticipated). (HWJ).

19859 (CONF-8711230—, pp 171-186) **Carburetor fuel composition and emissions.** Marhold, A. (Oesterreichische Mineraloelverwaltung A.G., Vienna. Technischer Pruefstand Lobau). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

A small proportion of the conversion losses in running Otto engines can be attributed to incomplete combustion. The amount of pollutants formed gives rise to serious concern in the light of the extent of mass-motoring. A more precise report is given of the influence of Otto fuels on the so-called regulated pollutants such as carbon monoxide, hydrocarbons and nitrogen oxides. The author goes into the causes and sources of emissions (combustion process, ventilation conditions) and the influences of fuel composition (Otto fuel is a mixture comprising many individual hydrocarbons, density fluctuations, electronic fuel injection, measuring results). Catalytic converter technology not only greatly reduces the concentration of the emitted pollutants, but it also reduces the influence of the fuel composition on pollutant emissions. (HWJ).

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 19447, 19800, 19858

19860 **(AD-A—200961/1/XAB) Kinetics of carboxylic acid formation in the combustion of alcohols. Interim report, 4 September 1986-1 September 1987.** Naegeli, D.W. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1987. 46p. (BLRF—254). NTIS, PC A03/MF A01.

Several studies have shown that low-temperature operation of spark-ignition engines on methanol fuel results in unusually high ring and cylinder bore wear. It has been found that the wear is caused by formic acid and peroxide formed in the low-temperature combustion of methanol. Bench studies have shown that combustion residues are formed when shallow pools of alcohols are burned. The residues were found to contain substantial concentrations of aldehydes, carboxylic acids, and peroxides. The objective of this study was to measure rates and to determine the kinetics of formation of carboxylic acids and peroxides observed in residues formed by burning shallow pools of liquid alcohols. An examination of the literature suggested strongly that carboxylic acid formation in alcohol combustion was probably caused by the reaction of hydrogen peroxide with aldehydes. The kinetics of the reactions of hydrogen peroxide with formaldehyde, deuterated formaldehyde acetaldehyde, and chloral were examined in aqueous solution. Rate constants and equilibrium constants are given in the report for the respective decompositions and formations of the methylenehydroxyperoxide-type intermediates proposed to exist in the reactions of hydrogen peroxide with aldehydes.

19861 (CONF-8711230—, pp 65-120) **Additives: Yes or no?.** Giere, H.H. (Aral A.G., Bochum (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770288/JAW.

From 4. information seminar on practical requirements on fuel quality; Vienna, Austria (18 Nov 1987).

This two-part report goes into the pros and cons of using additives. Basis research covered problems of deposits (blocking inlet

valves, sludging up the engine, deposits on fuel injection valves) and the solution of the problems by putting additives into the fuel (keeping the mixture-formation system and inlet valves clean, influence of octane level, engine sludge). Corresponding solutions are then given for diesel fuels. The author reports on an experiment programme to document what additives do and the effects of using them on criteria of an application-related technical nature. Considerable advantages result from using fuel additives in terms of engine function, engine life, running costs and environmental compatibility. (HWJ).

19862 **(ORNL/Sub—87-91333/1) Analysis of the combustion of four alternate fuels in a diesel engine using high speed photography: Final report.** Abata, D.L.; Masterson, D. (Oak Ridge National Lab., TN (USA); Michigan Technological Univ., Houghton (USA). Coll. of Engineering). Feb 1989. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007907/JAW.

Ignition and combustion of four alternate fuels in a direct injected, two stroke, single cylinder diesel engine were investigated with high speed photography. The four fuels studies were: (1) Canadian 1990 Tar Sands fuel, (2) 57% Exxon Donor Solvent, (3) 100% Exxon Donor Solvent, and (4) neat methanol. Experimental results, obtained at half and full rack positions at 750 rpm, were compared to baseline No. 2 diesel fuel. Optical access to the combustion chamber was provided by a large quartz window in the piston crown and extended piston-cylinder arrangement. The combustion chamber of the engine, when viewed through the piston crown (from below) was axisymmetric in shape with the injector located in the center of the chamber. The engine was equipped with spark assist, although the assist was only necessary with two of the fuels. Further details of the engine can be found in the text of this report. High speed motion photography of the combustion process was obtained at 10,000 frames per second. Subsequent analysis of the motion photography allowed characterization of the ignition and combustion process of each of the fuels. 14 refs., 15 figs., 3 tabs.

19863 **(PB—89-136147/XAB) Sample-preparation techniques for evaluating methanol and formaldehyde emissions from methanol-fueled vehicles and engines. Technical report.** Pidgeon, W.M.; Reed, M.P. (Environmental Protection Agency, Ann Arbor, MI (USA)). 19 Sep 1988. 19p. (EPA/AA/TEB—88/02). NTIS, PC A03/MF A01.

This report describes the wet Chemistry procedures used by the Emission Control Technology Division, Test and Evaluation Branch of the E.P.A. Motor Vehicle Emission Laboratory in evaluating methanol fuels for use in motor vehicles. The report describes the formaldehyde and methanol wet-chemistry procedures used. Included is elution changes, volume measurement, sample contamination issues, preparation procedures, and various appendices.

35 ARMS CONTROL

REFER ALSO TO CITATION(S) 19675

3501 Policy, Negotiations, And Legislation

19864 **(UCRL—100268) Ethics and nuclear weapons research.** Brown, P.S. (Lawrence Livermore National Lab., CA (USA)). 20 Jan 1989. Contract W-7405-ENG-48. 22p. (CONF-890178—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006737/JAW.

From Ethical issues of military research; Washington, DC, USA (26 Jan 1989).

This report discusses the ethical implications of nuclear weapons research. The roles and concerns of scientists in developing and conducting nuclear research are also discussed. 14 refs.

36 MATERIALS

REFER ALSO TO CITATION(S) 21416

19865 **(LBL—24242) Materials and Chemical Sciences Division annual report, 1987.** (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 295p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008838/JAW.

Research programs from Lawrence Berkeley Laboratory in materials science, chemical science, nuclear science, fossil energy, energy storage, health and environmental sciences, program development funds, and work for others is briefly described. (CBS)

19866 **(LBL—25912) Center for Advanced Materials: Annual report, 1987.** (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 123p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008854/JAW.

Research programs from Lawrence Berkeley Laboratory in materials research are described. Programs headings include: polymers and composites; instrumentation for surface science; structural materials; ceramic and metal interfaces; electronic materials; surface science and catalysis; enzymatic synthesis of materials; and industry participation. A list of publications resulting from research staffing and awards follow each section. (CBS)

19867 **(N—89-13671) Materials processing research base of the Materials Processing Center. Annual report, year ending 30 September 1986.** (Massachusetts Inst. of Tech., Cambridge (USA)). Sep 1986. 61p. (NASA-CR—183016; NAS—1.26:183016). NTIS, PC A04/MF A01.

An annual report of the research activities of the Materials Processing Center of the Massachusetts Institute of Technology is given. Research on dielectrophoresis in the microgravity environment, phase separation kinetics in immiscible liquids, transport properties of droplet clusters in gravity-free fields, probes and monitors for the study of solidification of molten semiconductors, fluid mechanics and mass transfer in melt crystal growth, and heat flow control and segregation in directional solidification are discussed.

19868 **(N—89-14264) Materials and structures for hypersonic vehicles.** Tenney, D.R.; Lisagor, W.B.; Dixon, S.C. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1988. 46p. (NASA-TM—101501; NAS—1.15:101501; CONF-8808144—). NTIS, PC A03/MF A01.

From 16. congress of the International Council of the Aeronautical Sciences; Jerusalem, Israel (28 Aug 1988).

Hypersonic vehicles are envisioned to require, in addition to carbon-carbon and ceramic-matrix composities for leading edges heated to above 2000 F, such 600 to 1800 F operating temperature materials as advanced Ti alloys, nickel aluminides, and metal-matrix composited; These possess the necessary low density and high strength and stiffness. The primary design drivers are maximum vehicle heating rate, total heat load, flight envelope, propulsion system type, mission life requirements and liquid hydrogen containment systems. Attention is presently given to aspects of these materials and structures requiring more intensive development.

19869 **(ORNL/Sub—86-00210/1) Energy Conversion and Utilization Technologies (ECUT) Program: Materials by design: Assessment of theoretical and experimental tools for applied research and exploratory development on certain energy technologies.** Broach, R.W. (ed.); Eades, R.A. (ed.); Low, J.J. (ed.); Barr, T.L. (ed.); Carpenter, J.A., Jr. (ed.). (Oak Ridge National Lab., TN (USA); Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center). Feb 1989. Contract AC05-84OR21400. 503p. NTIS, PC A22/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008010/JAW.

The directive for this assessment is to determine whether it is, or soon will be, feasible to develop, verify, and then utilize theoretical models of certain interatomic phenomena in order to design

and optimize practical engineering processes and materials. The interatomic phenomena which form the focus of the assessment are in the technologically important areas of heterogeneous catalysis, tribology, and adhesion in materials science. A determination of the prospects for gaining such a modeling capability requires an assessment of the present and projected future status of: (1) the ability of theoretical methods to characterize and model certain interatomic phenomena in a realistic manner; (2) the availability of high speed, large memory computing machinery (supercomputers) with sufficient power to effectively implement and apply the theoretical methods; and (3) the capacity of advanced experimental techniques to observe and identify the atomic nature of the specified phenomena in industrial processes and materials. The assessment described in this report was derived from the results of three tasks; each task determining the status of one of the areas named above. This document presents the findings obtained from the performance of those tasks.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 19211, 19211, 19307, 19307, 19313, 19374, 19519, 19541, 19584, 19585, 19606, 19609, 19645, 19654, 19751, 19837, 20040, 20123, 20129, 20194, 20226, 20252, 20261, 20300, 20312, 20313, 20314, 20332, 20451, 20469, 20956, 21341, 21369, 21375, 21383, 21384, 21522, 21534, 21594

19870 (ANL—89/3) Advanced materials in the manufacturing revolution: Proceedings. Nevitt, M.V.; Peterson, N.D. (eds.). (Argonne National Lab., IL (USA)). Feb 1989. Contract W-31109-ENG-38. 91p. (CONF-8806303—). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008190/JAW.

From Conference on advanced materials in the manufacturing revolution; Argonne, IL, USA (14 Jun 1988).

A conference at Argonne National Laboratory for senior executives of small and medium-size manufacturing companies covered technical and managerial issues involved in adapting advanced materials and new manufacturing methods. Seven speakers discussed how high performance metals, alloys, ceramics, polymerics and their composites are replacing conventional mill-product materials and how these new materials are impacting manufacturing methods and products.

19871 (ANL/PPRNT—89-141) Rutherford backscattering study of high temperature oxidation of Y implanted Fe-24Cr. King, W.E.; Grabowski, K.S.; Mitchell, D.F.; Baldo, P.M. (Argonne National Lab., IL (USA)). Apr 1987. Contract W-31109-ENG-38. 43p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008341/JAW.

We have investigated the effect of Y ion implantation on the high temperature oxidation of Fe-24Cr using Rutherford backscattering spectroscopy, secondary ion mass spectroscopy, and analytical electron microscopy. Results indicate that implantation of Y has a very large effect on the growth rate of the oxide compared to metals alloyed with Y. Analytical tools have been applied to determine the spatial distribution of Y, the microstructure of the oxide, and contribution of oxygen transport to the oxidation process. Results are compared with those of recent cation diffusion measurements in $Cr_2O_3$and Cr_2O_3 doped with Y_2O_3. 35 refs., 19 figs., 4 tabs.

19872 (ANL/PPRNT—89-145) A new scaling relation for sputtered NbN films. Capone, D.W. II; Gray, K.E.; Kampwirth, R.T. (Argonne National Lab., IL (USA)). Feb 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008349/JAW.

We have discovered a scaling relation connecting the properties of NbN films made at different sputtering rates. For a given sputtering rate, as a function of increasing argon partial pressure (P/sub Ar/) we observe a linear reduction of T/sub c/ and a rapid increase in H/sub c2/ (4.2 K) followed by saturation. This produces a maximum in J/sub c/ (measured at 19 T and 4.2 K) vs P/sub Ar/. Films having similar high field superconducting properties (H/sub c2/ and J/sub c/) and microstructures can be made at higher sputtering rates (> 60 {angstrom}/s) if a higher argon gas pressure is used. A simple scale factor determines the argon pressure necessary. This scaling relation may provide some insight into those factors in the sputtering process which are important in determining the superconducting properties and microstructure of sputtered NbN films. 10 refs., 2 figs.

19873 (ANL/PPRNT—89-151) Freely-migrating defect production during irradiation at elevated temperature. Hashimoto, T.; Rehn, L.E.; Okamoto, P.R. (Argonne National Lab., IL (USA)). Mar 1987. Contract W-31109-ENG-38. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008336/JAW.

Radiation-induced segregation in a Cu-lat.% Au alloy was investigated using in situ Rutherford Backscattering Spectrometry. The amount of Au atom depletion in the near surface region was measured as a function of dose during irradiation at 350{degree}C with four ions of substantially different masses. Relative efficiencies for producing freely-migrating defects were evaluated for 1.8 MeV ^{1}H, ^{4}He, ^{20}Ne and ^{84}Kr ions by determining beam current densities that gave similar radiation-induced segregation rates. Irradiations with primary knock-on atom median energies of 1.7, 13 and 79 keV yielded relative efficiencies of 53, 7 and 6%, respectively, compared to the irradiation with a 0.83 keV median energy. Despite quite different defect and host alloy properties, the relative efficiencies for producing freely-migrating defects determined in Cu-Au are remarkably similar to those found previously in Ni-Si alloys. Hence, the reported efficiencies appear to offer a reliable basis for making quantitative correlations of microstructural changes induced in different alloy systems by a wide variety of irradiation particles. 27 refs., 9 figs., 3 tabs.

19874 (ANL/PPRNT—89-154) Advanced LMFBR fuel cladding susceptability to stress corrosion due to reprocessing impurities. Henslee, S.P. (Argonne National Lab., Idaho Falls, ID (USA)). Mar 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008455/JAW.

The potential degradation of LMFBR fuel cladding alloys by chlorides, when used in metallic fuel systems, was evaluated. The alloys tested were D-9 and HT-9 stainless steels, austenitic and ferritic alloys respectively. These two alloys were tested in parallel with and their performance compared to the austenitic stainless steel Type 316. All alloys were tested for 7400 hours in a stress rupture environment with chloride exposure at either 550{degree}C 650{degree}C. None of the alloys tested were found to exhibit any degradation in time-to-rupture by the presence of chlorides under the conditions imposed during testing. 8 refs., 4 figs., 2 tabs.

19875 (ANL/PPRNT—89-159) Relativistic electronic structure and superconductivity of Nb_3Ge, Nb_3Sn, and Nb_3Sb. Chen, Shi-min; Jansen, H.J.F.; Freeman, A.J.; Koelling, D.D. (Argonne National Lab., IL (USA)). Apr 1987. Contract W-31109-ENG-38. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008459/JAW.

The electronic band structures of Nb_3Ge, Nb_3Sn, and Nb_3Sb were calculated self-consistently by the LAPW method using 32 general {rvec k}-points in the irreducible Brillouin zone (IBZ); the self-consistent potentials were used to extend the calculations of the eigenvalues and wave functions with 68 regular {rvec k}-points positioned on high symmetry lines and planes of the IBZ. The eigenvalues at a total of 100 {rvec k}-points were employed to obtain Fourier fits of the energy bands with 60 symmetrized plane waves. All relativistic effects were considered in the calculation of the band structures. The densities of states (DOS) and the joint DOS were determined by the analytical tetrahedral technique. Our calculated values of the electron-phonon interaction parameter, λ, and the superconducting transition temperature, T/sub c/, are in good agreement with experiment. 41 refs., 8 figs., 6 tabs.

19876 (ANL/PPRNT—89-167) Unoccupied electronic states and surface phenomena for YBa_2Cu_3O/sub 6.9/. Wagener, T.J.; Gao, Y.; Weaver, J.H.; Arko, A.J.; Flandermeyer, B.; Capone, D.W. II. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008356/JAW.

Inverse photoemission was used to probe the unoccupied electronic levels within 25 eV of E/sub F/ for the high temperature superconductor YBa_2Cu_3O/sub 6.9/. Our results show that the density of states is low from E/sub F/ to {approximately}3.7 eV. Large emission features appearing at 6.5 eV and 8.6 eV are associated with Ba 5d- and Y 4d-derived bands, respectively, while structure at 14 eV above E/sub F/ is due to localized Ba 4f states. Energy dependent studies reveal a dispersive band between {approximately}4 and {approximately}6 eV above E/sub F/. An oxygen- induced feature was observed at 1.8 eV, but there is no evidence that high-energy electron-stimulated-desorption removes these chemisorption states.

19877 **(ANL/PPRNT—89-173) Electromotove force measurements using rubidium β{double←prime} alumina electrolyte: Molten Rb-Bi alloys.** Petric, A.; Pelton, A.D.; Saboungi, M.-L. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008477/JAW.

A Rb-β{double←prime} alumina solid electrolyte was developed by the exchange of Na-β{double←prime} alumina in RbCl and used to measure the emf of liquid Rb-Bi alloys by means of concentration cells. Values of ΔG, ΔH and ΔS are reported for the temperature range 600--883 K. All were highly negative, indicating strong interaction between Rb and Bi in the melt. The excess stability was found to have two peaks, one at the 1:1 composition and the second near the stoichiometric 3:1 ratio. Liquidus points on the phase diagram were measured over most of the composition range. 16 refs., 8 figs., 4 tabs.

19878 **(CONF-881155—47) Structural energy differences in Al_3Ti: The role of tetragonal distortion in APB and twin energies.** Nicholson, D.M.; Stocks, G.M.; Temmerman, W.M.; Sterne, P.; Pettifor, D.G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007210/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

At stoichiometry, DO_{22} is the observed ground state of Al_3Ti and has a C/A ratio of 2.23, but as a function of both concentration and temperature other ordered arrangements of APB's are observed. These phase transitions have sparked many studies in which the energy has been treated as that of chemical rearrangement on an fcc lattice. We have found that at the ideal C/A ratio, the $L1_2$ structure is lower in energy, but as the tetragonal distortion increases the DO_{22} energy drops below that of $L1_2$. The critical role played by the tetragonal distortion in the balance between $L1_2$ and DO_{22} energies precludes the use of any model based on the undistorted lattice. The major impediment to the development of Al_3Ti as a high-temperature material is its lack of ductility. The standard approach is to make alloy additions which transform the structure to $L1_2$. Al_3Ti can be stabilized in $L1_2$ by the addition of Fe, Ni, or Cu, however, it remains brittle. An alternate approach is to work toward the enhancement of ductility in the DO_{22} phase. As a first step in a search for alloy additions which will reduce the twinning energy and improve twin related ductility, we have calculated the twinning energy in Al_3Ti.

19879 **(CONF-881155—49) Effect of aluminum level on boron clustering in Ni_3Al.** Horton, J.A.; Miller, M.K.; Liu, C.T.; George, E.P.; Bentley, J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007837/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

In alloys containing 0.24% boron, atom-probe field-ion microscopy (APFIM) revealed the presence of boron clusters in Ni-25 at. % Al and Ni-26 Al but not in Ni-24 Al. The observed boron clusters generally consisted of two to three boron atoms with a maximum size of 10 atoms. Quench rates that ranged from rapid solidification to furnace cooling had little effect on the clustering. The occurrence of the clustering coincides with a higher rate of boron strengthening as measured by an increase in the yield stress per atomic percent boron, and it also coincides with a reduced amount of boron segregation to grain boundaries. The levels of nickel and boron were highly variable on grain boundaries in rapidly solidified material and therefore no consistent indication of nickel enrichment at the grain boundaries associated with boron segregation was found. This result suggests that cosegregation of nickel with boron may not be necessary for the ductilization of Ni_3Al by boron, since the rapidly solidified material is also ductilized by boron and exhibits segregation of only boron to the grain boundaries. 24 refs., 5 figs., 3 tabs.

19880 **(CONF-8808122—17) Electronic structure of disordered CuPd alloys by positron-annihilation 2D-ACAR.** Smedskjaer, L.C.; Benedek, R.; Siegel, R.W.; Legnini, D.G.; Stahulak, M.D.; Bansil, A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007258/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

We report 2D-ACAR experiments and KKR CPA calculations on alpha-phase single-crystal Cu/sub 1-x/Pd/sub x/ in the range $x \leqq 0.25$. The flattening of the Fermi surface near [110] with increasing x predicted by theory is confirmed by our experimental results. 16 refs., 2 figs.

19881 **(CONF-8809215—5) Physical properties of grain-boundary materials: Comparison of EAM [embedded-atom-method] and central-force potentials.** Wolf, D.; Lutsko, J.; Kluge, M. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007414/JAW.

From Atomistic modelling in materials - beyond pair potentials; Chicago, IL, USA (27 Sep 1988).

Three types of grain-boundary phenomena expected to be particularly sensitive functions of a local-volume dependence in the interatomic interaction potentials employed are investigated by means of many-body (embedded-atom and Finnis-Sinclair) and pair potentials. These phenomena are the zero-temperature volume expansion localized at the grain boundaries, the local elastic constants of grain-boundary materials, and their high-temperature stability. The same qualitative behavior is found in all these phenomena for both types of potentials, from which it is concluded that the local-volume dependence, incorporated in the many-body potentials only, does not have a strong effect on the predicted properties of grain-boundary materials. The reasons for these similarities are thought to arise from the fact that most grain-boundary properties are governed, as are those of liquids, by atoms in very close contact; i.e., by the short-range part of the interatomic potential which is of a central-force type in both sets of potentials. However, many-body potentials are expected to represent a given material better than pair-potentials since (1) they usually permit a larger number of adjustable parameters to be fitted to real-material properties, and (2) in contrast to equilibrium pair-potentials they do not satisfy the Cauchy relation. 34 refs., 16 figs.

19882 **(CONF-8810279—2) Ultrasonic attenuation measurements of the flux lattice phase transition in the heavy fermion superconductor UPt_3.** Adenwalla, S.; Zhao, Z.; Ketterson, J.B.; Hinks, D.G.; Schenstrom, A.; Hong, Y.; Xu, M.F.; Levy, M.; Sarma, B.K. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007394/JAW.

From Institute of Electrical and Electronic Engineering meeting; Chicago, IL, USA (2 Oct 1988).

Attenuation measurements of longitudinal ultrasound in superconducting UPt_3 show a peak, below H/sub c2/, which depends strongly on the orientation of the field relative to the c-axis. This peak is seen only with longitudinal sound and not with transverse sound. 12 refs., 5 figs.

19883 **(CONF-8811161—2) Structure maps and phase stability in $AlTi_3$ alloyed with rare-earth elements.** Liu, C.T.; Horton, J.A.; Pettifor, D.G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005106/JAW.

From MRS symposium on high-temperature ordered intermetallic alloys; Boston, MA, USA (28 Nov 1988).

Rare-earth elements including Y, Er and Sc were added to $AlTi_3$ for stabilizing the $L1_2$ ordered crystal structure, as predicted by the AB_3 structure map. The crystal structure and phase composition in the $AlTi_3$ alloys were studied by electron microprobe analysis, x-ray diffraction and TEM. All the results indicate that rare-earth additions are unable to change the crystal structure of $AlTi_3$ from DO_{19} to $L1_2$. The failure to stabilize the $L1_2$ structure cannot be simply related to atomic size and solubility limit of the rare-earth elements in $AlTi_3$. 17 refs., 5 figs., 1 tab.

19884 **(CONF-8811161—3) Phase and microstructure of Fe modified Al_3Ti.** Porter, W.D.; Hisatsune, K.; Sparks, C.J.; Oliver, W.C.; Dhere, A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89007526/JAW.

From MRS symposium on high-temperature ordered intermetallic alloys; Boston, MA, USA (28 Nov 1988).

Alloys of Al/sub 75-x/, where x = 0 to 12 at. % Fe, were fabricated by splat cooling and examined primarily with x-ray diffraction to determine the crystallographic phases present, their composition, volume fraction, lattice parameters, and sublattice occupation. The tetragonal DO_{22} structure of Al_3Ti dissolved 0.8{+-}0.4 at. % Fe, with additional iron partitioned to the Ll_2 structure containing 6.2{+-}0.4 at. % Fe, and completed the transformation to the Ll_2 structure with the addition of about 6 at. % Fe. The lattice parameters of both phases were independent of iron concentration up to about 6 at. %. At 8 at. % Fe, the iron was found to be predominantly distributed on the nominal aluminum sublattice which also contained about 5 at. % Ti. The Al_3Ti composition was similarly found to contain about 5 at. % Ti on the aluminum sublattice. All compositions, including a single crystal of $Al_{67}Fe_8Ti_{25}$, were found to be brittle. 11 refs., 4 figs., 1 tab.

19885 **(DOE/ER/45095—3) Vibrational and optical properties of amorphous metals: Progress report and projected research, July 1, 1988--June 20, 1989.** Lannin, J.S. (Pennsylvania State Univ., University Park (USA). Dept. of Physics). Feb 1989. Contract FG02-84ER45095. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008366/JAW.

This report covers progress and projected research in vibrational and optical properties of amorphous metals. Topics covered are: the setup and initiation of thin film deposition and analysis capabilities in ultrahigh vaccuum, Auger and LPS measurements on ion bombarded films of a-$Ni_{95}Tb_5$ films that have been studied by diffraction and inelastic neutron scattering measurements, and Raman scattering measurements on crystalline $NiSi_2$metals. (JL)

19886 **(EUR—11756) Study of phase transformations in Fe-Mn-Cr Alloys.** Schule, W.; Panzarasa, A.; Lang, E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1988. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757201/JAW.

Nickel free alloys for fusion reactor applications are examined. Phase changes in fifteen, mainly austenitic iron-manganese-chromium-alloys of different compositions were investigated in the temperature range between -196/sup 0/C and 1000/sup 0/C after different thermo-mechanical treatments. A range of different physical measuring techniques was employed to investigate the structural changes occurring during heating and cooling and after cold-work: electrical resistivity techniques, differential thermal analysis, magnetic response, Vickers hardness and XRD measurement. The phase boundary between the α Fe-phase and the γ-phase of the iron manganese alloy is approximately maintained if chromium is added to the two component materials. Consequently all the alloy materials for contents of manganese smaller than about 30% Mn are not stable below 500/sup 0/C. This concerns also the AMCR alloys. However the α Fe-phase is not formed during slow cooling from 1000/sup 0/C to ambient temperature and is only obtained if nucleation sites are provided and after very long anneals. A cubic α Mn-type-phase is found for alloys with 18% Cr and 15% Mn, with 13% Cr and 25% Mn, with 10% Cr and 30% Mn, and with 10% Cr and 40% Mn. For these reasons the γ-phase field of the iron-chromium-manganese alloys is very small below 600/sup 0/C and much narrower than reported in the literature. 95 figs. 22 refs.

19887 **(FRCEA-TH—141) Hydrogen gas embrittlement of stainless steels mainly austenitic steels. Volumes 1 and 2.** Azou, P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France); Paris-6 Univ., 75 (France)). 1988. 612p. (In French). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88757206/JAW.

Steel behavior in regard to hydrogen is examined especially austenitic steels. Gamma steels are studied particularly the series 300 with various stabilities and gamma steels with improved elasticity limit for intermetallic phase precipitation and nitrogen additions. A two-phase structure $\gamma + \alpha'$ is also studied. All the samples are tested for mechanical behavior in gaseous hydrogen. Influence of metallurgical effects and of testing conditions on hydrogen embrittlement are evidenced. Microstructure resulting from mechanical or heat treatments, dislocation motion during plastic deformation and influence of deformation rate are studied in detail.

19888 (INIS-mf—11897, pp 30.1-30.24) **On the influence of the material toughness and the state of stress on fracture of large scale specimens.** Roos, E.; Eisele, U.; Silcher, H.; Spaeth, F. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The results obtained with the SENT samples (20 MnMoNi 55 (USA) and 22 NiMoCr 37 (KS07)) show the analysis of the multi-axis degrees of stress condition to be an important tool in the fracture-mechanics description of the failure course. Results suggest that sample failure will begin in the minimum of the multi-axis ratio. This minimum is locally restricted to the notch bottom; hence, study results gained to date suggest stable crack growth. However, if there is a continuously high multi-axis degree in the ligament, sample failure without previous stable crack growth will have to be reckoned with.

19889 (INIS-mf—11897, pp 31.1-31.26) **Determination of fracture mechanics properties of welded joints and comparison with the failure behaviour of wide plates.** Dahl, W.; Ehrhardt, H.; Heuser, A.; Hubo, R.; Twickler, R.; Uwer, D. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Eisenhuettenkunde; Thyssen Stahl A.G., Duisburg (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

35 mm thick plates from steels 15 MnNi 6 3 and 20 MnMoNi 5 5 were welded by submerged-arc and electro-slag welding. The fracture behaviour of the different heat-affected zones was studied in the as-welded condition and after stress-relief annealing using the notched-bar impact test, the fracture mechanics test, and tests on medium-sized notched-tensile test specimens and large plates. Brittle fracture safety was assessed by the ductile-to-brittle transition temperatures of the different tests. The fracture mechanics results were used to determine the failure behaviour of large plates based on the R6 method.

19890 (INIS-mf—11897, pp 32.1-32.20) **Experimental data from instrumented, impact-loaded, center-cracked, medium-scale, tensile specimen of fine-grain steels.** Joas, H.; Meyer, A.; Schmitt-Thomas, K.G. (Technischer Ueberwachungs-Verein Bayern e.V., Muenchen (Germany, F.R.); Technische Univ. Muenchen (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The development of new instrumentation for testing allows to obtain materials data from medium-sized notched and impact-loaded CCP specimens concerning fracture strength, yield strength, carbon content, and microstructure condition. These data allow a meaningful and systematic selection or development of materials for optimum deformation and ductile strength properties of impact-loaded components. This also applies to welded joints. The study involved 315 ISO-V tests and 125 CCP tests.

19891 (INIS-mf—11897, pp 33.1-33.28) **Dynamics testing of large AISI 316L steel specimens behaviour using L.D.T.F.** Casadei, F.; Delzano, C.; Magonette, G.; Halleux, J.P.; Verzeletti, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1986. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The paper presents the results of a series of dynamic experiments on AISI-316L steel specimens having a cross section of 2000 mm/sup 2/ and a gauge length of 350 mm subject to dynamic traction up to rupture. Results for dynamic tests at a nominal strain rate up to 50 s/sup -1/ are compared to quasi-static ones, showing an important increase in both yield stress and flow stress. The experimental techniques are described, with special emphasis on full-field optical strain measurements based on Moire interferometry. A 1-D numerical analysis of the experiments is presented.

19892 (INIS-mf—11897, pp 34.1-34.30) **Classification and characterization of materials by means of fracture mechanics parameters.** Roos, E.; Eisele, U.; Beyer, H.; Gillot, R. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Issues of fracture mechanics and the determination of corresponding data in the lower shelf, higher shelf and, pointwise, in the transition range of the notch-impact energy temperature curve were demonstrated using four materials from the research project 'Komponentensicherheit' (component safety) (20 MnMoNi 55 = KS 17; 22 NiMoCr 3 7 = KS 01; 22 NiMoCr 37 = KS 07 A/B; 17 MoV 84 = melt KS 22). The crack arresting characteristics measured in material KS 22 suggest that the K/sub Ia/ values also reach a level which is below the reference curves.

19893 (INIS-mf—11897, pp 35.1-35.21) **Influence of the loading rate on the crack resistance curve and the initiation temperature.** Packeiser, R.; Aurich, D.; Ziebs, J. (Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Concerning the steel grades studied (22 NiMoCr 3 7), crack-initiation-related criteria can be used for failure assessment at steady load as from room temperature (S23 ≅ 10/sup 0/C, KS01 ≅ 30/sup 0/C); at dynamic load with a stress velocity of about 1 m/sec, however, these can only be used as from 30/sup 0/C (S23) or 60/sup 0/C (KS01). The transition behaviour of steels is often characterized by notch impact tests only. The study gave an opportunity to check this approach for its intrinsic value.

19894 (INIS-mf—11897, pp 36.1-36.16) **Ultra-large size austenitic stainless steel forgings for fast breeder reactor: Development, manufacturing and properties achieved.** Tsukada, H.; Suzuki, K.; Sato, I.; Miura, R. (Japan Steel Works Ltd., Muroran, Hokkaido. Muroran Plant). 1986. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

SUS F 304 austenitic stainless steel forgings for reactor vessel of Monju, including the largest forgings ever manufactured so far such as upper flange (8,770 mm O.D.), upper intermediate shell (7,160 mm O.D.) and bottom head (6,570 mm O.D. in chord), was presented in the outline of manufacturing and properties.

19895 (JAERI-M—88-192) **Compilation of structural property data for computer impact calculation (2/5). Mild steel.** Ikushima, Takeshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 83p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756909/JAW.

The paper describes structural property data for computer impact calculations of nuclear fuel shipping casks. Four kinds of material data, mild steel, stainless steel, lead and wood are compiled. These materials are main structural elements of shipping casks. Structural data such as, the coefficient of thermal expansion, the modulus of longitudinal elasticity, the modulus of transverse elasticity, the Poisson's ratio and stress and strain relationships, have been tabulated against temperature or strain rate. This volume 2 involve structural property data of mild steel.

19896 (JAERI-M—88-193) **Compilation of structural property data for computer impact calculation (3/5). Stainless steel.** Ikushima, Takeshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 139p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756910/JAW.

The paper describes structural property data for computer impact calculations of nuclear fuel shipping casks. Four kinds of material data, mild steel, stainless steel, lead and wood are compiled. These materials are main structural elements of shipping casks. Structural data such as, the coefficient of thermal expansion, the modulus of longitudinal elasticity, the modulus of transverse elasticity, the Poisson's ratio and stress and strain relationships, have been tabulated against temperature or strain rate. This volume 3 involve structural property data of stainless steel.

19897 (JAERI-M—88-194) **Compilation of structural property data for computer impact calculation (4/5). Lead.** Ikushima, Takeshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 113p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756911/JAW.

The paper describes structural property data for computer impact calculations of nuclear fuel shipping casks. Four kinds of material data, mild steel, stainless steel, lead and wood are compiled. These materials are main structural elements of shipping casks. Structural data such as, the coefficient of thermal expansion, the modulus of longitudinal elasticity, the modulus of transverse elasticity, the Poisson's ratio and stress and strain relationships, have been tabulated against temperature or strain rate. This volume 4 involve structural property data of lead.

19898 **(KFTI—87-20) Cascade effects on coalescence of segregation in two-phase systems.** Kiryukhin, N.M.; Sagalovich, V.V.; Slezov, V.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705576/JAW.

The evolution of binary precipitations in ternary alloys has been theoretically investigated taking into account cascade fracture of precipitations. The equation for the growth of such particle rate is obtained. A set of equations for describing the behaviour of the precipitation ensemble is stated, analytical solutions for this system in different limiting cases at a late stage (coalescence stage) are obtained. It is shown that the function of second-phase particle distribution in size in the material considered trends to universal. The presence of cascade leads to displacement of region boundaries, where coalescence occurs. The theoretical results obtained allow to describe qualitatively a number of mechanisms of precipitation behaviour under radiation observed experimentally. 15 refs.; 1 fig.

19899 **(KI—1987-5) Corrosion in hot-water systems for energy distribution - subprojects 2, 4 and 7.** Thoren, A. (Swedish Corrosion Inst., Stockholm). 10 Feb 1988. 33p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757047/JAW.

Subproject 2: The report deals with development of laboratory test methods for corrosion protection additives for hot water systems. The object of the work has been development of methods giving users of additives a possibility of testing commercial products under controlled conditions. Suggested methods comprise screen test with electrochemical methods and by oxygen analysis as well as electrochemical measurements, oxygen analysis and weight loss measurements in a laboratory hot water loop. Subproject 4: Corrosion rate and oxygen content measurements have been made in operating district heating systems with five different waters. The waters had additives of different oxygen scavengers and different degasification. Corrosion measurements have been made electrochemically with linear polarization technique, with resistance measurement probes and by weight loss measurement. The results of corrosion rate measurements in different systems are discussed. The methods are evaluated and discussed with respect to applicability in the systems in question. Subproject 7: The work comprises measurements of the corrosion rate of steel-coupons at two different distances from the dosage point of make up water in a district heating system. The system has a degasified not softened water without corrosion protective additives. The results from mesurements after 5 and 33 weeks exposure respectively are discussed.

19900 **(LA—11456-MS) Equilibrium pressure measurements in the beta region of palladium protide and palladium deuteride.** Carstens, D.H.W.; David, W.R. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008309/JAW.

We have measured the pressure-composition isotherms of the palladium-deuterium and palladium-protium systems in the beta region of both and the plateau region of the protide. For these two systems, data were measured at pressures up to about 3.5 MPa (500 psi) and at temperatures from 173 to 473 K. This study extends to a greater pressure and temperature regime the work on palladium hydrides reported previously by other authors. We also report results of an empirical analytical fit to the data for these two isotope systems. For completeness, we have applied our analysis to previously reported data for the tritide. The data were fit to an equation of the form $P = \exp\{A + 2\ln[R/(1 - R)]-(B - CR)/T\} + \exp[D + E/T]$, where R is the hydrogen-to-metal atomic ratio, P is the pressure, and T is the temperature. A, B, C, D, and E are empirically determined parameters and differ for absorbing and desorbing systems of each isotope. This equation gives a good fit to the data in the beta region of the absorption curves but a poorer fit in the alpha plus beta (plateau) region. 15 refs., 6 figs.

19901 **(LA-UR—89-115) Atomistic simulations of interfaces in metals and alloys.** Chen, S.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-881155—45). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006521/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

We have used embedded atom potentials to simulate the surfaces, thin films and grain boundaries in metals (Ni and Al) and alloys (NiAl and Ni_3Al). The calculated surface relaxations and ripplings of free surfaces are in good agreement with experiments. A new interference phenomena of interlayer relaxation in thin films are observed in the simulation. The segregation behavior of B and S and their effects on the mechanical properties of Ni_3Al are correctly predicted with potentials fitted to data obtained by electronic band structure calculations.

19902 **(LA-UR—89-249) Shear banding in titanium with controlled elongations at 10^6/sec.** Staudhammer, K.P.; Gray, A.J. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 9p. (CONF-890324—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006555/JAW.

From 4. international conference on mechanical properties of materials at high rates of strain; Oxford, UK (20 Mar 1989).

Adiabatic shear bands were obtained in titanium with controlled strains to 10.8%. Two types of shear bands were observed and characterized. In general the quantity and shear band width increased with increasing elongation. At elongations below {approximately}5% the shear bands were typically characteristic of shear bands observed at lower strain rates. Above 5% elongations many of the shear bands contained a boundary regime adjacent to the shear band and increased in width with increasing total elongation. This effect was attributed to the strain heat. 14 refs., 9 figs.

19903 **(LBL—26145) Nb modification of microcomposite Fe/C/Cr/Mn steel.** Kim, Jongkeun. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 99p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008297/JAW.

A microcomposite steel which is desired to be attained in this investigation, is a composite microstructure consisting of fine packets of heavily dislocated martensite laths surrounded by continuous thin films of interlath retained austenite. Heavily dislocated lath martensite gives ultrahigh strength; a softer, tough austenite phase provides high fracture toughness. This composite microstructure has been achieved in the Fe/Cr/Mn/C system containing more than a total of four percent of alloying elements in previous work. The present work is concerned with obtaining superior combinations of mechanical properties by adding the microalloy element of niobium to the basic quaternary alloy of Fe/2.0 wt % Cr/1.2 wt % Mn/0.25 wt % C and by applying controlled rolling practice to processing of the experimental alloys to attain fine austenite grains, giving rise to high Charpy V-notch impact toughness. The basis is to have sufficient hardenability after retrenching the chromium content, so that processing will not destroy the microcomposite structure of heavily dislocated martensite laths and thin films of interlath retained austenite after the martensite phase transformation, following rolling and quenching. 57 refs., 30 figs., 4 tabs.

19904 **(LBL—26381) Characterization of Nb-Al superconducting material.** Im, Yoonsoon. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 126p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008296/JAW.

The superconducting A15 phase formation in the Nb/Al binary system was studied in order to provide a systematic approach toward achieving optimum processing conditions for Nb/Al superconducting wires. A series of Nb/Al multi-layered thin-film samples was made to simulate reactions in powder metallurgy (P/M) processed wires while a Nb-Al bulk sample was made by an arc-welding technique to study reactions in the bulk. It was found that the reactions in P/M wires and multi-layered thin-film samples were governed by kinetics while those in the bulk sample were governed by thermodynamics. The optimum Al/Nb layer configuration to avoid remaining Nb or Nb_2Al was qualitatively calculated to be 1100{angstrom} {approximately} 1260{angstrom} for Nb and 290{angstrom} {approximately} 330{angstrom} for Al. The average Nb filament thickness and the critical current densities of various superconducting wires showed good correlation in spite of the differences in processing and the microstructural inhomogeneity. It

was shown that the critical current density of a superconducting wire increased by improving its Nb/Al filament distribution. It is concluded that the critical current density of a Nb/Al superconducting wire can be maximized if Nb and Al filaments are reduced to the optimum thickness range and homogeneously distributed. 118 refs., 48 figs., 3 tabs.

19905 **(LBL—26385) High resolution electron microscopy study of as-prepared and annealed tungsten-carbon multilayers.** Nguyen, T.D.; Gronsky, R.; Kortright, J.B. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 18p. (CONF-881155—50). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007664/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

A series of sputtered tungsten-carbon multilayer structures with periods ranging from 2 to 12 nm in the as-prepared state and after annealing at 500{degree}C for 4 hours has been studied with high resolution transmission electron microscopy. The evolution with annealing of the microstructure of these multilayers depends on their period. As-prepared structures appear predominantly amorphous from TEM imaging and diffraction. Annealing results in crystallization of the W-rich layers into WC in the larger period samples, and less complete or no crystallization in the smaller period samples. X-ray scattering reveals that annealing expands the period in a systematic way. The layers remain remarkably well-defined after annealing under these conditions. 12 refs., 4 figs., 1 tab.

19906 **(LBL—26449) Mechanisms of fatigue crack propagation and fracture toughness behavior in advanced aluminum-lithium alloys.** Venkateswara Rao, K.T. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 196p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008300/JAW.

Mechanisms and mechanics influencing the fatigue crack propagation and plain-stain fracture toughness behavior commercial aluminum-lithium alloys are investigated as a function of the microstructure and plate orientation, both at ambient and liquid nitrogen temperatures. With ultra-low density, improved elastic modulus and high strength, in comparison to existing 7XXX and 2XXX alloys, the alloys additionally exhibit superior long ({approx←gt} 10 mm) fatigue crack properties, even after prolonged exposures at high temperatures, excel under tension-dominated spectrum loading and in some instances show superior fracture toughness values at ambient and liquid nitrogen temperatures. However, the properties are strongly dependent on plate orientation; moreover, the benefits of lithium additions are not realized for small (2--1000 μm) fatigue cracks. 260 refs., 72 figs., 11 tabs.

19907 **(N—89-13493) Evaluation of coated columbium test panels having application to a secondary nozzle extension for the RL10 rocket engine system, parts 1 and 2. Final report.** Murphy, K.S.; Castro, J.H. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA)). Dec 1988. 135p. (NASA-CR—180809; NAS—1.26:180809). NTIS, PC A07/MF A01.

The activity performed on the screening and evaluation of various coatings for application on columbium alloy test panels representative of a radiation-cooled nozzle extension for the RL10 rocket engine is summarized. Vendors and processes of candidate coatings were evaluated. Post engine test evaluations of the two selected coatings are discussed.

19908 **(N—89-13554) Study of microstructural characteristics of Ni-based superalloys at high temperatures. Semiannual technical report.** Lal, R.B.; Aggarwal, M.D. (Alabama A and M Univ., Normal, AL (USA)). Nov 1988. 59p. (NASA-CR—183377; NAS—1.26:183377; AAMU-NAG—002). NTIS, PC A04/MF A01.

The microstructural characteristics of the Ni-based superalloy MAR-M246(Hf) which is used in manufacturing the components of the Space Shuttle's main engine have been studied. These superalloys need optimal heat treatment to get the best results. To find the optimum heat treatment the technique of differential thermal analysis and the optical photomicrographs are being planned to be utilized. In the first phase, the existing experimental equipment like cutting, grinding/polishing machines and metallurgical microscope have been set up to cut/polish and take the photomicrographs. In the beginning of this year an order was placed for the Leitz Mettalux-3 microscope with a hot stage for in-situ observation of the superalloy samples. The hot stage was tested for the first time, alloying the thermocouple with the Tantulum heating element and has not been installed finally by the supplier. A Perkin Elmer Differential Thermal Analyzer (DTA 1700) was procured in the first year of the project. Samples of MAR-M246(Hf), MAR-M247, Waspaloy, Udimet-41, CMSX-2 and CMSX-3 (polycrystalline and single crystals) have been studied using differential thermal analyzer.

19909 **(N—89-13566) Effect of 0.1 atomic percent zirconium on the cyclic oxidation behavior of beta-NiAl for 300 hours at 1200 C.** Barrett, C. A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 19p. (NASA-TM—101408; E—4366; NAS—1.15:101408; CONF-8809190—). NTIS, PC A03/MF A01.

From Workshop on the oxidation of high-temperature intermetallics; Cleveland, OH, USA (20 Sep 1988).

The long time effect of 0.1 at percent Zr (0.2 wt percent Zr) on the cyclic oxidation behavior of hipped beta-NiAl was studied. Oxidation testing was performed in static air at 1200 C for up to 3000 one-hour exposure cycles. Specific weight change versus time data was modeled with the COSP computer program to analyze cyclic oxidation behavior. The Zr-free stoichiometric alloy oxidized and spalled randomly to bare metal between cycles at a rate high enough to deplete Al to a low enough level that oxidation breakaway took place as nonprotective NiO replaced the alpha-Al_2O_3/$NiAl_2O_4$ scale as the controlling oxide. The Zr minimized this severe type of spalling maintaining the protective alpha-Al_2O_3 scale even out to 3000 hours for the stoichiometric alloy with no significant Al depletion. A third beta-NiAl alloy containing 0.1 at percent Zr but with 10 percent less Al than the stoichiometric alloy was also tested and showed some depletion of Al, but the protective Al_2O_3/$NiAl_2O_4$ was still maintained to close to 2700 hours.

19910 **(N—89-13642) Thermal barrier coatings. Abstracts and figures.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1985. 220p. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—). NTIS, PC A10/MF A01.

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The Thermal barrier coatings Workshop was held May 21 and 22, 1985, at the NASA Lewis Research Center in Cleveland, Ohio. Six sessions covered Failure Mechanisms and Life Modeling, Effects of Oxidation and Creep, Phase Stability and Microstructural Aspects, Nondestructive and Analytical Assessment, Coating Development, and Alternative Applications.

19911 (N—89-13642, pp 1-7) **Development of thermomechanical life prediction models for thermal barrier coatings.** Strangman, T.E. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Thermal barrier coatings (TBCs) for turbine airfoils in high-performance engines represent an advanced materials technology with both performance and durability benefits. The foremost TBC benefit is the reduction of heat transferred into air-cooled components. To achieve these benefits, however, the TBC system must be reliable. Mechanistic thermomechanical and thermochemical life models and statistically significant design data are therefore required for the reliable exploitation of TBC benefits on gas turbine airfoils. Garrett's NASA-HOST Program (NAS3-23945) is designed to fulfill these requirements. This program focuses on predicting the lives of two types of strain-tolerant and oxidation-resistant TBC systems that are produced by commercial coating suppliers to the gas turbine industry. The plasma-sprayed TBC system, composed of a low-pressure plasma-spray (LPPS) applied oxidation resistant NiCrAlY bond coating, and an air-plasma-sprayed yttria partially stabilized zirconia insulated layer is applied by both Chromalloy and

Klock. The second type of TBC is applied by the electron beam-physical vapor deposition process by Temescal. Thermomechanical life models are being tailored to predict TBC strain tolerance in terms of materials, engine, and mission parameters. Continuum and fracture mechanics approaches and statistical methods are being evaluated to develop tensile and compressive strain functions required to drive a mission analysis capable thermomechanical life model for TBCs. Results of initial testing to calibrate these life models will be presented.

19912 (N—89-13642, pp 9-25) **Mechanisms of thermal barrier coating degradation and failure.** Demasi, J.T.; Sheffler, K.D. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The objectives and initial results of a Thermal barrier coating (TBC) Life Prediction Model Development Program are described. The goals of this program are to: identify and understand TBC failure modes; generate quantitative TBC life data; and develop and verify a TBC life prediction model. The coating being studied is a two layer thermal barrier system incorporating a nominal ten mil outer layer of seven percent yttria partially stabilized zirconia plasma deposited over an inner layer of highly oxidation resistant low pressure plasma sprayed NiCrAlY bond coating. This coating currently is in flight service on turbine vane platforms in the JT-9D and PW2037 engines and is bill-of- material on turbine vane airfoils in the advanced PW4000 and IAE V2500 engines. Effort currently is in progress on the first task, which involves the identification and understanding of TBC failures. Five modes of coating damage were considered: thermomechanical ceramic failure; oxidative bond coat failure; hot corrosion; foreign object damage (FOD); and erosion.

19913 (N—89-13642, pp 27-32) **Performance and reliability model for thermal barrier coatings.** Batakis, A.P. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

A modeling technique for predicting the performance and reliability of TBC's is being developed at Solar Turbines Incorporated. The concept combines experimental coating property data with finite element analyses to predict the thermal and mechanical behavior of coating systems in service. A key feature of Solar's approach is the use of a four point flexure test to estimate coating strength distributions and to predict coating failure probability. This model was used to evaluate the effect of physical variations on coating performance in high heat flux rocket engine applications for NASA. Current work, promoted by Caterpillar Tractor Company for diesel engine applications, is being conducted to measure coating strength as a function of temperature, and future work will document strength degradation with time at temperature. Solar's interest lies in the application of TBCs to gas turbine engine components.

19914 (N—89-13642, pp 33-42) **Effect of oxidation on the high heat flux behavior of a thermal barrier coating.** Miller, R.A. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The effect of oxidation on the high heat flux behavior of a thermal barrier coating was evaluated by cyclically exposing preoxidized specimens to a 3000 C nitrogen plasma. The thermal barrier coatings consisted of a 0.025 cm layer of air-plasma-sprayed ZrO2-7 percent Y2O3 and a 0.012 cm layer of low pressure-plasma-sprayed NiCoCrAlY applied over 0.13 cm diameter B1900+Hf cylindrical substrates. A gradient of 800 C is produced across the ceramic layer in each 0.5 second exposure. This is much more severe than the gradient encountered on a gas turbine engine. Prior to exposure, the specimens were preoxidized at 1200 C for time from 0 to 20 hours. These coatings were found to be tolerant to the high heat flux plasma flame for all but the most severe preoxidations. However, life degraded rapidly for preoxidation times in excess of 15 hours at 1200 C. A log-log plot of cycles-to-failure vs estimated oxidative weight gain yield a straight or nearly straight line, and this line could be rationalized using an oxidation-based model that was developed previously for low heat flux applications.

19915 (N—89-13642, pp 43-52) **Effect of bond coat creep and oxidation on TBC integrity.** Duderstadt, E.C.; Pilsner, B.H. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The potential of thermal barrier coatings (TBCs) on high-pressure turbine (HPT) nozzles and blades is limited at present by the inability to quantitatively predict TBC life for these components. The goal is to isolate the major TBC failure mechanisms, which is part of the larger program aimed at developing TBC life prediction models. Based on the results of experiments to isolate TBC failure mechanisms, the effects of bond coat oxidation and bond coat creep on TBC integrity is discussed. In bond coat oxidation experiments, Rene prime 80 specimens coated with a NiCrAlY/ZrO2-8 percent Y2O3 TBC received isothermal pre-exposures at 2000 F in static argon, static air, or received no pre-exposure. The effects of oxidation due to the pre-exposures were determined by thermal cycle tests in both static air and static argon at 2000 F. To study the effect of bond coat creep on TBS behavior, four bond coats with different creep properties were evaluated by thermal cycle tests in air at 2000 F. The test results, the relative importance of these two failure mechanisms, and how their effects may be quantified will also be discussed.

19916 (N—89-13642, pp 53-58) **Investigation of environmental influence on the creep behavior of a low pressure plasma sprayed NiCoCrAlY alloy.** Hebsur, M.G.; Miner, R.V. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Low pressure sprayed MCrAlY overlay coatings are currently being used on advanced single crystal superalloy blades for gas turbine engines. Many studies were made on the influence of coatings on the mechanical properties of superalloys in oxidizing or hot-corroding environments, but very few on the properties of the bulk coating alloy itself. The creep behavior of a typical NiCoCrAlY alloyd (PWA 276) was studied in air and vacuum. The as-received low pressure plasma sprayed NiCoCrAlY plates were heat treated for 4 h at 1080 C followed by 32 h at 870 C, the heat treatment applied to coated superalloy parts. Standard creep specimens 12.7 mm long and 3.2 mm in diameter were then machined. Constant load creep-rupture tests were performed in air and vacuum at 650, 850, and 1050 C and various initial stresses. In addition, some specimens were preoxidized at 1050 C for 100 h prior to testing. Results are briefly discussed.

19917 (N—89-13642, pp 179-186) **Microlaminate composites: an alternate approach to thermal barrier coatings.** Bunshah, R.F.; Deshpandey, C.V.; Obrien, B.P. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Ceramic thermal barrier coatings suffer from a major drawback, i.e., brittle behavior. An alternate approach is microlaminate composite coatings consisting of alternate layers of metal and oxide. As the thickness of the individual laminae decrease while keeping the total thickness of the coating constant, the thermal conductivity drops markedly. Data on the Fe-Cu system will be presented. A model is proposed for an MCrAlY-Al2O3 microlaminate coating for thermal barriers. The methods of fabrication will also be discussed.

19918 (N—89-14297) **Oxidation behavior of FeAl+Hf,Zr,B.** Smialek, J.L.; Doychak, J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 15p. (NASA-TM—101402; E—4486; NAS—1.15:101402; CONF-8809190—). NTIS, PC A03/MF A01.

From Workshop on the oxidation of high-temperature intermetallics; Cleveland, OH, USA (20 Sep 1988).

The oxidation behavior of Fe-40Al-1Hf, Fe-40Al-1Hf-0.4B, and Fe-40Al-0.1Zr-0.4B (at. percent) alloys was characterized after 900, 1000, and 100 C exposures. Isothermal tests revealed parabolic kinetics after a period of transitional theta-alumina scale growth. The parabolic growth rates for the subsequent alpha-alumina scales were about five times higher than those for NiAl+0.1Zr alloys. The isothermally grown scales showed a propensity toward massive scale spallation due to both extensive rumpling from growth stresses and to an inner layer of HfO2. Cyclic oxidation for 200 1-hr cycles produced little degradation at 900 or 1000 C, but caused significant spallation at 1100 C in the form of small segments of the outer scale. The major difference in the cyclic oxidation of the three FeAl alloys was increased initial spallation for FeAl+Zr,B. Although these FeAl alloys showed many similarities to NiAl alloys, they were generally less oxidation resistant. It is believed that this resulted from nonoptimal levels of dopants and larger thermal expansion mismatch stresses.

19919 **(ORNL/Sub—84-89628/02) Study of particle rebound characteristics and material erosion at high temperature.** Tabakoff, W.; Hamed, A.; Eroglu, H. (Oak Ridge National Lab., TN (USA); Cincinnati Univ., OH (USA). Dept. of Aerospace Engineering and Engineering Mechanics). Dec 1988. Contract AC05-84OR21400. 87p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007926/JAW.

The rebound characteristics of 15 micron mean diameter fly ash particles impacting several target materials were measured using Laser Doppler Velocimetry (LDV). Detailed results including the effects of various parameters were given in a previous report. This report focuses on the effects of new additional parameters on the rebound characteristics. First, the restitution parameters are reported at small impact angles (less than 15 degrees) for 410 stainless steel, 2024 aluminum, 6Al-4V titanium, INCO 718, RENE 41, AM 355, L605 cobalt and alumina (Al_2O_3). The fly ash rebound data for these target materials are then investigated in an effort to develop generalized correlations for the restitution coefficients. The effect of the target surface geometry on the rebound characteristics is investigated for 2024 aluminum as the next step. Finally, three-dimensional (3-D) rebound characteristics are presented for fly ash particles impacting INCO 718 and 2024 aluminum target materials. Semiempirical erosion rate equations are reported for 2024 aluminum, INCO 718, RENE 41 and AM355 alloys from the experimental erosion results for fly ash and silica sand particles at various particle velocities and material temperatures. 18 refs., 86 figs.

19920 **(ORNL/TM—11038) Shield optimization program: Part 6, The effect of impurity layers on the hydrodynamic response of a beryllium target to mono-energetic x-rays using the PUFF-TFT code.** Smith, M.S.; McNeany, S.; Santoro, R.T.; Gabriel, T.A. (Oak Ridge National Lab., TN (USA)). Mar 1989. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007874/JAW.

Calculations were performed using the PUFF-TFT code to determine the thermo-mechanical response arising from incident mono-energetic X-rays on a beryllium substrate with a thin (300{angstrom}) impurity layer. The impurities were introduced into the material during typical fabrication processes. Responses were calculated for 5 nanosecond square wave pulses of monoenergetic X-rays (1 and 2 keV) with fluence levels corresponding to surface loadings of 1 and 5 cal/cm^2. The presence of these surface impurities was found to significantly alter the thermal response of the medium. As the concentration of surface impurities increased, the energy deposition increased, and the temperature gradient increased. In some cases, additional impurities resulted in a phase change in the medium. For the most part, the mechanical response was unaffected by the surface impurity concentration. 6 refs., 48 figs., 1 tab.

19921 **(PB—89-135800/XAB) Caracterization of CVD boron carbide deposits: application to steel casing.** Lartigue, S. (Etablissement Technique Central de l'Armement (ETCA), 94 - Arcueil (France). Centre Mecanique Chimie Materiaux). 29 Sep 1987. 169p. (In French). (ECTA—87-R-096). NTIS, PC E08/MF E08.

Boron carbide CVD deposits were created using boron trichloride, methane, and hydrogen. A kinetic study based on deposit parameters led the authors to propose different mechanisms limiting the growth speed of the solid. The deposit areas and heat stability of the synthesized phases were determined and a boron carbide equilibrium diagram is proposed. Optimization of boron carbide deposits on steel was achieved through successive, concerted, experimental plans. Interactions between the B-C-Cl-H system and the substrate, and particularly the principal diffusion phenomena, were established. The physical properties of the deposits were studied using tribology and measurements of hardness.

19922 **(SAND—88-1073) A model for interface temperatures induced by convection heat transfer in porous materials.** Baer, M.R. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1989. Contract AC04-76DP00789. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008202/JAW.

An evolutionary relationship for granular interface temperature is developed for use in multiphase heat transfer models. Temperature at particle surfaces within a packed bed are represented by the thermal fields of isolated spheres. An integral method is used for the solution of thermal conduction within individual grains and approximations are employed for the limits of large and small Biot number. A composite of these solutions is formulated which treats a broad range of transient heat transfer. The resulting model is a differential equation which easily adapts to Eulerian or Lagrangian multiphase models. To test this simplified model, several comparisons to exact and model solutions were conducted investigating the transient thermal response of a convectively heated isolated sphere. 10 refs., 9 figs.

19923 **(SAND—88-1558C) Shock-induced chemical synthesis of intermetallic compounds.** Work, S.J.; Yu, Li-Hsing; Thadhani, N.N.; Meyers, M.A.; Graham, R.A.; Hammetter, W.F. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 30p. (CONF-8810203—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007035/JAW.

From International symposium on combustion and plasma synthesis of high temperature materials; San Francisco, CA, USA (23 Oct 1988).

Shock synthesis experiments were performed on elemental powder mixtures of Ni-Al and Nb-Al, to study the effect of material parameters on solid-state chemical synthesis. Elemental powders of different morphologies were pre-mixed in a proportion of {approximately}65 wt% Ni, or Nb, and 35 wt% Al. Shock-compression loading experiments were conducted on Ni-Al mixtures at 19-22 GPa pressures using the Sandia Bear fixtures, and on Nb-Al mixtures at 30-40 GPa pressures using a 12-capsule Sawaoka recovery fixture. In the case of Ni-Al mixtures the starting powder morphology plays a significant role in determining the extent of reaction. The Nb-Al powder mixtures shock processed at higher pressures underwent complete reaction. Preliminary results of the shock synthesis experiments on the nickel and niobium aluminide systems are presented, with particular emphasis on the characteristics of the reaction products. 32 refs., 13 figs., 1 tab.

19924 **(STU—85-5404) 10:th Scandinavian Corrosion Congress NKM 10. Proceedings.** Mattsson, E. (ed.). (Swedish National Board for Technical Development, Stockholm). 15 Dec 1986. 426p. (CONF-8606347—). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW.

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The congress was arranged by the Swedish Corrosion Institute, 2-4 June 1986, in Stockholm. 48 lectures and 35 poster presentations were given. The number of attendees was c:a 270. 75 of the presentations have been published in proceedings in English. The number of contributions according to the session grouping were as follows: * Plenary lectures, 4; * Automotive corrosion, 2; * Atmospheric corrosion, 4; * Corrosion in energy production and transportation, 11; * Corrosion in sea water, 6; * Corrosion properties of stainless steels, 6; * Corrosion theory, 4; * Corrosion protection by coatings, 6; * Testing technique, 9; * Corrosion in soil, 6; * Corro-

sion of steel in concrete, 2; * Electrochemical corrosion protection, 4; * Corrosion properties of non-ferrous metals, 5; * Special topics 6. Proceedings were published as Bulletin no 10 of the Swedish Corrosion Institute. Separate abstracts were prepared for 26 papers of this report. (O.S.).

19925 (STU—85-5404, pp 19-26) **Atmospheric corrosion of electronics.** Leygraf, C.; Zakipour, S.; Henriksen, J.; Villien, P.; Wagner, M. (Swedish Corrosion Institute, Stockholm (SE); Norwegian Institute of Air Research, Lillestroem (NO); Elektronikcentralen, Hoersholm (DK)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Even minor amounts of corrosion products caused by subparts per million levels of airborne contaminants can generate premature failure or complete breakdown of electronic components or equipments. This survey describes some of the more commonly occurring corrosion processes and outlines a joint Nordic research project which covers various important aspects of the corrosion of electronic materials. (With 16 refs.) (authors).

19926 (STU—85-5404, pp 39-42) **Corrosion rates of various metals in SO/sub 2//NO/sub 2/ polluted atmospheres.** Henriksen, J.F.; Rode, A. (Norwegian Institute of Air Research, Lillestroem (NO)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

A study of the influence of NO/sub 2/ on metallic corrosion in SO/sub 2/ polluted atmosphere has been carried out on six different metals. NO/sub 2/ is shown to have an inhibiting effect on steel and aluminium corrosion, but an accelerating effect on copper and gold-plated nickel. The corrosion of zinc and silver does not seem to be influenced by an addition of NO/sub 2/ gas. (authors).

19927 (STU—85-5404, pp 43-48) **Role of NO/sub 2/ in the atmospheric corrosion of different metals.** Ericsson, P.; Johansson, L.G. (9860272SE;). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The influence of NO/sub 2/ and combinations of NO/sub 2/ and SO/sub 2/ on the atmospheric corrosion of steel, copper, zinc and aluminium has been studied in the laboratory. The synthetic atmosphere contained 0.2 or 1.3 ppm SO/sub 2/ and 0.3 or 3.0 ppm of NO/sub 2/. Relative humidity was 50 or 90%. NO/sub 2/ caused corrosion of all four metals although the attack was not very rapid. Combined with SO/sub 2/ however, NO/sub 2/ strongly accelerated corrosion in some cases, e.g. with steel at 50% humidity and with copper at 90% humidity. (authors).

19928 (STU—85-5404, pp 65-72) **Corrosion of aluminium in water-based heat-exchanger systems.** Sigurdsson, H.; Tusvik, R. (SINTEF, Trondheim (Norway)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Corrosion of aluminium in artificial tapwater with 50% ethylene glycol, has been studied by weigthloss measurements, surface studies of local attacks and electrochemical techniques The emphasis has been on the effect of temperature and temperature-variations and the presence of copper (metallic and ionic) on the corrosion susceptibility of Al in the presence of several inhibitors. The results indicate that the corrosion rate and the depths of local attacks generally are biggest at conditions of a constant high temperature (80 deg C), compared with temperature conditions which alternate between the high and a lower (30 or 50 deg C) temperature. During alternating temperature the corrosion rate is usually highest under the high-temperature period of the temperature cyclus. In the presence of a nitrate-borate inhibitor the situation is reversed however, as the general corrosion rate is considerably higher at alternating temperature (30 to 80 deg C), with the rate being at it's maximum under the low-temperature period. The corrosion rate of metallic copper is further found to be high at 80 deg C, and Cu-ions are found to be detrimental to the corrosion properties of aluminium at concentrations as low as 0.01 ppm Cu/sup 2+/. A mixed inhibitor containing NO/sub 3/-, PO/sub 4(sup 3)/-, B/sub 4/O/sub 7(sup 2)/, SiO/sub 3(sup 2)/-, MBT and NaOH (pH = 8.5), is found to be very effective in completely suppressing corrosion of both aluminium and copper under the experimental conditions. (With 11 refs.) (authors).

19929 (STU—85-5404, pp 79-82) **Corrosion in district heating and central heating systems with plastic tubes.** Molander, A. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

To achieve an effective heat transport in district heating systems the use of plastic pipes is attractive due mainly to their flexibility. However, when plastic pipes are used in conventional heating systems with carbon steel components, questions are often raised concerning increased corrosion due to the oxygen permeability of the plastic pipes. In this work the corrosion situation in such systems have been studied by laboratory experiments and by investigations of real systems. The results show that the corrosion rate in systems with plastic pipes is higher than in conventional metallic systems, but under normal conditions the durability of carbon steel components should not be affected. However the increased amounts of corrosion products formed in the systems can cause problems with deposits and flow disturbances. At high temperatures and at high oxygen inlets there is also a risk for pitting corrosion. Thus combination of plastic pipes and carbon steel should be avoided when designing new systems. For such systems pipes with oxygen barriers or systems with a modified design should be used.

19930 (STU—85-5404, pp 103-107) **High temperature corrosion of some nickel-base super alloys.** Pehkonen, A.; Tikkanen, M.H.; Ylaesaari, S.; Forsen, O. (Helsinki Univ. of Tech., Espoo (FI). Laboratory of Corrosion Science and Applied Electrochemistry). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The high temperature corrosion of some nickel-base super alloys was studied in atmospheres containing O/sub 2/, N/sub 2/ and SO/sub 2/. The influence of Na/sub 2/SO/sub 4/ was also studied. The corrosion products were examined by X-ray diffractometer. It was found that the corrosion rate was lowest, when the chromium content of the alloys was highest and Mo and Cu was found to increase the corrosion rate. The main corrosion products formed in air atmosphere were NiO and Cr/sub 2/O/sub 3/. In hot corrosion tests NiS and and Cr/sub 5/S/sub 8/ were found. In atmospheres containing both SO/sub 2/ and O/sub 2/ the oxidation layer consisted of NiS and Cr/sub 2/O/sub 3/. (authors).

19931 (STU—85-5404, pp 109-111) **Erosion-corrosion of tubes and tube bends in CLF slurry systems.** Engman, U. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Slurry erosion testing of SS 2343 tube bends have been made in the slurry loop at Studsvik Energiteknik AB. The slurry has consisted of coal-water mixture to simulate the erosion behaviour obtained when using coal liquid fuels. The wear has been determined as a function of the flow velocity, tube diameter and bending radius. Maximum wear in the bend, which was an order of magnitude higher than the wear in the straight tube, was obtained 60-90 degrees from the direction of the incoming flow.

19932 (STU—85-5404, pp 117-121) **Examination of corrosion problems in Norwegian hydroelectric power stations.** Steinsmo, U.; Bardal, E.; Johnsen, R. (SINTEF, Trondheim (Norway); Statoil, Trondheim (NO)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Corrosion of steel structures in three Norwegian hydro electric power stations has been studied. The most common type of corrosion was found to be formation of pits underneath hemispherical iron deposits. The average corrosion rate in the pits varied from 0.04 to about 0.5 mm per year. The investigations indicate that these corrosion problems are due to the activity of the iron bacteria Gallionella. (authors).

19933 (STU—85-5404, pp 129-134) **Corrosion in chlorinated North Sea water.** Henrikson, S. (SH-Korrosionskonsult, Vagnhaerad (SE)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

High alloy stainless steels have been exposed to chlorinated (2 mg Cl/sub 2//l) North Sea water at 35 deg C in the form of simulated tube to tube plate joints, simulated flange joints with rubber asbestos gaskets and simulated pipe assembly welds. For comparison the steels have also been tested in 10% FeCl/sub 3/ .6H/sub 2/O at the same temperature according to ASTM G 48-76. Other materials tested were 90/10 CuNi, NiAl bronze and titanium coupled to stainless steel, mild steel cathodically protected by zinc and aluminium anodes and type 316 stainless steel protected by soft iron anodes. Additional exposures are in progress under intermittent chlorination and in chlorine-free water.

19934 (STU—85-5404, pp 143-148) **Crevice corrosion of high alloy stainless steels in natural sea water.** Drugli, J.M.; Rogne, T.; Johnsen, R. (SINTEF, Trondheim (Norway); Statoil, Trondheim (NO)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Polarization tests with crevices formed between stainless steel specimens with and without welds have been carried out in natural sea water. Stepwise potential scanning with long holding time at each potential step has been used. Initiation potential, repassivation potential and corrosion rate calculated from the crevice corrosion current are given for tests performed at 90 deg C and 30 deg C. The importance of keeping the potential low in the first period of exposure is demonstrated. Transpassive crevice corrosion by polarization at high potential values is shown. (authors).

19935 (STU—85-5404, pp 149-154) **Galvanic corrosion of copper alloys in contact with a highly alloyed stainless steel in seawater.** Wallen, B.; Andersson, T. (Avesta AB, Avesta (SE)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Galvanic pairs of varying area ratios have been exposed to seawater on the Swedish west coast for one year. In most couples the cathodic member has been the highly alloyed stainless steel 254 SMO and the anodic member one of several copper alloys. Muntz metal was rapidly attacked by dezincification at all area ratios, but Al- and NiAl-bronze, 90-10 and 70-30 copper-nickel and Monel 400 were compatible with 254 SMO at 1:1 area ratio. 254 SMO was compatible with titanium and Alloy C-276 at all area ratios tested. Titanium caused approximately the same degree of corrosion on copper alloys and on mild steel as did 254 SMO. 254 SMO was completely resistant in all tests except when coupled to Monel 400 at the 11:1 area ratio. It is believed that crevice corrosion of the latter alloy has created such aggressive conditions that secondary corrosion was induced on 254 SMO in the metal-metal crevice. Starting from the results of three metal tests the corrosion conditions existing in a condenser, retrofitted with 254 SMO tubes, are discussed. (authors).

19936 (STU—85-5404, pp 155-160) **Corrosion resistance of cast aluminium alloys in marine environments.** Nielsen, K.; Soerensen, J.B.; Yding, F. (Korrosionscentralen, Broendby (DK)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Eight cast aluminium alloys with and without anodizing were exposed for three years to sea water and to a marine atmosphere the alloys being sprayed with sea water once an hour. Corrosion was assessed by measuring maximum pit depths, by metallographic examination and by measuring change in tensile strength. In the atmosphere, the alloys showed generally satisfactory behaviour, with maximum pit depths from < 0.1 mm - 1 mm and losses in tensile strength from 0-10%. When immersed in sea water, the alloys showed maximum pit depths from 0.3 - 9.5 mm, and losses in tensile strength were in some cases more than 50%. Anodizing was often beneficial in the atmosphere, but is considered less suited for immersed conditions. In some cases the anodized samples developed fewer but substantially deeper pits. (authors).

19937 (STU—85-5404, pp 171-177) **Formation of passive film on stainless steel in H/sub 2/S/Cl/sup -/ aqueous solution at high temperatures.** Olefjord, I.; Olefjord, Y. (Chalmers Univ. of Tech., Goeteborg (SE). Dept. of Engineering Metals). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

An austenitic steel (Sanicro 28) was exposed at room temperature, 100 and 260 deg C to aqueous solutions containing Cl/sup -/ ions with and without H/sub 2/S. The surface products were analysed by ESCA and high resolution scanning Auger microprobe. The passive film formed during exposure in H/sub 2/S-free solution at 25 deg C and 260 deg C are a 25 Aa thick Fe-Cr-oxide and a non-uniform Ni(OH)/sub 2/ respectively. In H/sub 2/S-containing environment, at 100 deg C, the surface product consists of a 1000 Aa thick layer of Cr/sub 2/O/sub 3/ and CrOOH. At 260 deg C the main reaction products formed on the surface are N/sub 3/S/ sub 2/, Cr/sub 2/O/sub 3/ and CrOOH. The thickness of the products is about 1 μm. Ni-sulphide occurs as particles on the surface. (authors).

19938 (STU—85-5404, pp 179-182) **SCC-resistance of ferritic-austenitic high-nickel stainless alloys.** Eriksson, H.; Norberg, P. (AB Sandvik Steel, Sandviken (SE). R and D Centre). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The following conclusions can be drawn from the investigation * The SCC resistance of duplex and high-nickel alloys is considerably higher than for standard austenitic stainless steels. * The concentrated MgCl/sub 2/-test is extremely aggressive and not suitable for evaluation of the SCC resistance of stainless steels in general. In the MgCl/sub 2/-test molybdenum has a detrimental effect on the SCC resistance, which is contrary to practical experience. * An aerated neutral 40% CaCl/sub 2/-solution at 100 deg C is adequate for ranking various stainless steels with regard to their SCC resistance in practise. * If the pH-value in the CaCl/sub 2/-test is lowered to 1.5, the detrimental effect of molybdenum is observed. The misleading results obtained in the MgCl/sub 2/-test may thus be explained by the low pH of this solution. (authors).

19939 (STU—85-5404, pp 189-194) **Effects of decontamination solutions on corrosion of welded stainless steels.** Varjonen, O.; Haenninen, H.; Muttilainen, E. (Technical Research Centre of Finland, Espoo (FI); Finnish Centre for Radiation and Nuclear Safety, Helsinki (FI)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Corrosion effects of some typical decontamination solutions were tested by using welded samples of AISI 304 steel (LTS-sensitized in the BWR-service for about 22000 h) and AISI 321 steel. The specimens were exposed to decontamination solutions for 5 periods to simulate repeated decontamination and the corrosion attack was measured as weight loss and observed by SEM. Secondly, the stress corrosion cracking susceptibility of the materials was studied by SSRT-technique in various decontamination solutions. Only one solution, strong CITROX-E, exhibited IGSCC in an AISI 304 weld heat affected zone. (authors).

19940 (STU—85-5404, pp 215-220) **Film formation and hydrogen evolution on carbon steel in CO/sub 2/-saturated solutions.** Vaaland, T.; Torgimsen, S.; Bugge, K. (Rogalandsforskning, Stavanger (NO)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The corrosion of mild steel in CO/sub 2/ saturated solutions has been studied. Three different solutions have been used. Two of them have compositions which roughly represents the formation water in sand stone reservoirs. One is with added bicarbonate, the other is without. The third solution is one representing a lime stone reservoir. A potensiostatic step technique has been used in the experiments. Before the steps are made, the electrodes are stabilized at certain potentials. During this stabilization, certain conditions are obtained on the surface. These can be studied by applying potensiostatic steps. It can be shown that both the anodic and the cathodic reactions are dependent on the potential at which the electrodes are stabilized. Also the electrolyte seems to play an important role. It is expected that at anodic potentials a film of iron carbonate is formed. This film formation seems to be independent on the type of electrolyte. At cathodic potentials an other type of film seems to be formed. The properties of this film is highly dependent on the type of electrolyte. (With 19 refs.) (authors).

19941 (STU—85-5404, pp 305-312) **Corrosion of steel and metal-coated steel in Swedish soils. Results of field exposures.** Camitz, G.; Vinka, T.G. (Swedish Corrosion Institute, Stockholm (SE)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The report presents a systematic long-term field study of corrosion of carbon steel and steel coated with zinc, Aluzink and aluminium in soil. The exposure is taking place in six localities with different types of soil. The specimens are buried in accordance with a special pattern so that the effects of different soil parameters can be recorded. The results after 1, 2 and 4 years exposure are presented. (With 17 refs) (authors).

19942 (STU—85-5404, pp 317-322) **Corrosion on hot galvanized power line pylons. A study of different investigation and evaluation methods.** Bergdahl, U. (Swedish Geotechnical Institute, Linkoeping (SE)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

The Swedish Geotechnical Institute and Sydkraft AB have been working on a new geotechnical model for the evaluation of the risk of corrosion on hot galvanized power line pylons founded in soil. A comparison has been made between the measured corrosion on a 40 year old power line and evaluations based on chemico-physical parameters. A model based on both geotechnical and chemico-physical parameters has shown the best correlation to the measured corrosion.

19943 (STU—85-5404, pp 323-330) **Corrosion and corrosion evaluation of superficial sediments on the Norwegian continental shelf.** Fischer, K.P.; Bryhn, O.R. (Marintek A/S, Sandefjord (NO); Norwegian Geotechnical Institute, Oslo (NO)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

In-situ corrosion tests and laboratory corrosion studies have been performed on superficial marine sediments from water depths down to 500 m. The corrosivity of the superficial sediments on the Norwegian continental shelf is generally low being in the range 1 to 50 μm/year. For most sediments which have a glacial or glaciomarine origin and have a low organic content the corrosion rate will be in the range 1 to 20 μm/year. However, in some limited areas, where the sediments contain a high amount of partly decomposed organic material, the corrosion rate can be as high as 360 μm/year. It is considered that the sulphide environment created by the reduction of the biogenous material will decide the corrosivity of these marine sediments. (authors).

19944 (STU—85-5404, pp 421-426) **Corrosion of water pipes due to acidification of natural waters.** Levlin, E. (Royal Inst. of Tech., Stockholm (SE). Dept. of Hydraulics Engineering). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

This investigation, which was done at the Swedish National Environmental Protection Board had the purpose to elucidate the contribution of acidification of natural waters by air pollution, to corrosion of water pipes, and to estimate the costs of corrosion damages caused by acidification. The investigation is divided into two parts, one on indoor water installations, and one on water pipes located in the ground. On indoor water pipes the investigation was done by examination of reports of water damages from the County Insurance Companies in 6 counties of Sweden. These water damages was divided into probable and non-probable corrosion damages. By comparing the percentage of probable corrosion damage with the geographical distribution of acidification effects, a connection was established between acidification and corrosion of indoor water pipes. It was calculated that acidification contributes to corrosion of indoor water pipes with annually about 140 million Swedish crowns. An attempt was also made to study the influence of acidification to corrosion of underground water pipes. It was however not possible, within the limits of this investigation, to find any connection between the frequency of corrosion of buried water pipes and acidification.

19945 **(SVF—308) Duplex stainless steels for applications in power plants. Stress corrosion tests in high temperature water containing oxygen and chloride.** Molander, A. (Studsvik Energy, Nykoeping (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); Studsvik Energy, Nykoeping (Sweden)). 15 Sep 1987. 49p. (In Swedish). (STUDSVIK-EX—87-64). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757103/JAW.

The work presented in this report forms the first experimental part of the project 'Duplex stainless steels for applications in power plants' started to investigate how duplex stainless steels can favourably replace conventional materials in power generating equipment. The corrosion resistance of duplex stainless steels are often better than for austenitic stainless steels, but background documentation for power plant applications is limited. The stress corrosion test presented in this report has been performed in the light of these facts. The test environment was water at 250 deg C with addition of oxygen to a nominal concentration of 10 ppb and sodium chloride to a chloride concentration of 1 000 ppm. Slow strain rate testing and exposure of corrosion coupons were performed. The following materials were tested: Type 439 (ferritic), Sandvik 3RE60, SAF 2304 and SAF 2205 (duplex), and Type 304, Type

304L, Type 316L and Alloy 800 (austenitic stainless alloys). Corrosion coupons from these alloys and the following steels were also included: St 35 (carbon steel), Type 409 and Type 444 (ferritic), and Sanicro 28 (austenitic stainless steel). Alloy 800 and SAF 2205 were not attacked by stress corrosion cracking during these conditions. Concerning general corrosion the duplex and the austenitic materials were superior to the ferritic steels.

19946 **(Y—2397) Experimental and analytical studies in quenching uranium-0.75% titanium alloy cylinders.** Llewellyn, G.H.; Aramayo, G.A.; Ludtka, G.M.; Park, J.E.; Siman-Tov, M. (Oak Ridge Y-12 Plant, TN (USA)). Feb 1989. Contract AC05-84OS21400. 169p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007696/JAW.

This is the second report on the immersion quenching of uranium-0.75 wt % titanium (U-0.75% Ti) alloy cylinders; it covers work done from October 1985 to October 1986. To more accurately evaluate the rate of heat removal during immersion quenching of the cylinders, experiments were conducted to monitor internal temperatures in the cylinder and to determine the surface temperature, heat flux, and heat transfer coefficient (HTC) by using inverse heat transfer techniques. A concentrated effort was made to develop a one-dimensional inverse heat conduction code, TAEH, that could convert the experimental data into useful boundary-condition input data. Enhanced three-dimensional models were formulated to accurately represent the immersion quenching process for the U-0.75% Ti alloy cylinders under a wire variety of boundary conditions. A submerged impinging jet was modeled, demonstrating the effect of nonsymmetrical boundary conditions on the bowing of cylindrical blanks during the quenching process. Experimentally determined HTCs were used as boundary conditions to model the immersion quenching of a vertical cylinder cooled with a submerged jet for comparison with an immersion quench using the standard steady-state correlations. 13 refs., 96 figs., 18 tabs.

19947 **Shapes of first-stage sinters.** Amar, F.; Bernholc, J.; Berry, R.S.; Jellinek, J.; Salamon, P. (University of Maine, Orono, Maine 04469). *Journal of Applied Physics;* **65**: No. 8, 3219-3225(15 Apr 1989).

The shape of first-stage sinters is derived within a framework in which a solid skeleton is wetted by a mobile"liquid" pool. Several lattices are considered as possible solid skeletons, corresponding to various degrees of surface versus grain boundary and volume transport; the effect of a nonzero dihedral angle at the interface between crystal faces is also treated. In some cases, significant differences exist between shapes calculated by minimizing the free energy and the shapes assumed by previous workers.

19948 **Instability of rapidly stretching plastic jets.** Romero, L.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **65**: No. 8, 3006-3016(15 Apr 1989).

A stability analysis of a rapidly stretching jet satisfying the equations of motion for a perfectly plastic material is presented. It is found that the stability of the jet depends on a dimensionless parameter Γ that measures the importance of the inertial forces relative to the plastic forces. This parameter is a decreasing function of time. It will be shown that jets with Γ initially very large will be stable until Γ decreases to order unity. These jets will then go unstable and break up into drops whose axial dimension is comparable to their radius. Jets with Γ initially small will always be unstable. It will be shown that these jets tend to break up into drops whose axial dimension is Γ^{-1}/sup //^{5} times their radius.

19949 **Domain structure and microstructure of CoNi oblique incidence thin films.** Ho, H.; Gau, G.J.; Thomas, G. (Department of Materials Science and Mineral Engineering, Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **65**: No. 8, 3161-3166(15 Apr 1989).

The magnetic properties of thin films produced by vacuum evaporation depend on the deposition conditions, such as incident angle(α) and substrate temperature. These effects have been investigated in CoNi oblique incidence thin films by transmission electron microscopy. Both incident angle and substrate temperature are observed to have significant effects on the magnetization easy direction in the films. Low-angle films ($\alpha \leqq 60^{\circ}$) are magnetically continuous with in-plane easy axes and reverse their magnetization by domain wall motion. On the contrary, high-angle films are magnetically isolated with an out-of-plane easy axis and reverse their magnetization by an incoherent rotation process. Microstructural results show that a c-axis texture increases with increasing incident angle. In high-angle films, the columns are single crystals and have a high defect density. The c axis of the columns does not coincide with the column axis. Thus, it is concluded that the origin of the magnetic anisotropy in low-angle films is mainly due to shape anisotropy. On the other hand, in high-angle films, crystalline anisotropy and stress anisotropy should be taken into account in addition to the shape anisotropy.

19950 **Modeling of laser planarization of thin metal films.** Marella, P.F.; Tuckerman, D.B.; Pease, R.F. (Solid-State Electronics Laboratory, Stanford University, Stanford, California 94305, and LP Program, Special Studies Division, Lawrence Livermore National Laboratory, Livermore, California 94550). *Applied Physics Letters;* **54**: No. 12, 1109-1111(20 Mar 1989).

The differences between excimer ($\approx$30 ns pulse duration) and flashlamp-pumped dye ($\approx$500 ns pulse duration) laser planarization are examined for 1.5—2 μm thick gold films over SiO_2 layers. Test structures containing bar patterns (square waves) of 5000 A peak-to-trough amplitude with spatial periods ranging from 10 to 100 μm were prepared and laser irradiated. A linear model is presented which described the time evolution of the film's surface topography when melted with a dye laser pulse. Excimer laser planarization is found to be susceptible to evaporative recoil effects which may cause undesired pattern amplification.

19951 **First-principles calculational methods for surface-vacancy formation energies, heats of segregation, and surface core-level shifts.** Feibelman, P.J. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185-5800). *Physical Review [Section] B: Condensed Matter;* **39**: No. 8, 4866-4872(15 Mar 1989).

The matrix Green's-function version of the self-consistent scattering theory of surface-point-defect energetics is extended to the cases of vacancy formation, substitutional adsorption, and surface core-level shifts. Vacancies are treated by zeroing Hamiltonian and overlap matrix elements involving orbitals of atoms being removed and crystal orbitals or the crystal potential. Substitutional adsorption is treated as ordinary adsorption in a vacancy, a treatment which permits use of an arbitrary number of substitutional-atom basis orbitals. Surface core-level shifts, including final-state relaxation effects, are obtained from substitutional adsorption calculations via the Born-Haber-cycle argument of Rosengren and Johansson. In a first comparison with experiment, the surface core-level shift for Al(001) is predicted to be -97 meV, modeling this system as a five-layer film, while different experimental groups report values ranging from 0 to -120 meV, respectively, for the Al(2p) level. Earlier calculations, which neglected final-state relaxation, predict a shift of -94 meV for the Al(1s) and about -120 meV for the Al(2s) and Al(2p) core levels. Comparison with the present result indicates that relaxation effects are small in the Al(001) surface core-level shift.

19952 **Electronic-structure calculation for metals by local optimization.** Woodward, C.; Min, B.I.; Benedek, R.; Garner, J. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439-4843). *Physical Review [Section] B: Condensed Matter;* **39**: No. 8, 4853-4861(15 Mar 1989).

Recent work by Car and Parrinello has generated considerable interest in the calculation of electronic structure by nonlinear optimization. The technique introduced by these authors, dynamical simulated annealing, is designed for problems that involve energy barriers. When local optimization suffices to determine the energy minimum, more direct methods are available. In this paper we apply the algorithm suggested by Williams and Soler to calculate the electronic structure of metals, using a plane-wave expansion for

the electronic orbitals and an electron-ion pseudopotential of the Kleinman-Bylander form. Radial pseudopotentials were taken from the compilation of Bachelet, Hamann, and Schlueter. Calculations are performed to optimize the electronic structure (i) with fixed atomic configuration, or (ii) with the atomic volume being optimized simultaneously. It is found that the dual optimization (ii) converges in essentially the same number of steps as the static lattice optimization (i). Numerical results are presented for Li, K, Al, and simple-cubic P.

19953 **Koshino-Taylor coefficient in electrical resistivity.** Mahan, G.D.; Wang, Z. (Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37996-1200). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 8, 4926-4929(15 Mar 1989).

At low temperatures the electrical resistivity of simple metals such as potassium has a T^2 term which is proportional to the concentration of impurities. This behavior was predicted by Koshino and Taylor. We provide an expression for the coefficient of the T^2 term. It is expressed as a function of the phase shifts of the scattering of the electron by the impurity.

19954 **Order-disorder transition of the W(001) surface.** Robinson, I.K.; MacDowell, A.A.; Altman, M.S.; Estrup, P.J.; Evans-Lutterodt, K.; Brock, J.D.; Birgeneau, R.J. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **62**: No. 11, 1294-1297(13 Mar 1989).

Synchrotron x-ray diffraction has been used to study the surface reconstruction of W(001) through its phase transition at around 230 K. We find that, although the superlattice peak intensity decreases a thousand fold over the range studied, the integrated intensity, and hence the structure factor, is nearly constant. This indicates that the surface undergoes an order-disorder transition with little change in the magnitude of the atomic displacements. The critical behavior is compared with predictions of the 2D XY and Ising models.

19955 **Neutron scattering study of the martensitic transformation in a Ni-Al β-phase alloy.** Shapiro, S.M.; Yang, B.X.; Shirane, G.; Noda, Y.; Tanner, L.E. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **62**: No. 11, 1298-1301(13 Mar 1989).

A high-resolution neutron scattering study of Ni/sub 62.5/ Al/sub 37.5/ shows that the martensitic transformation is associated with a homogeneous distortion and a nearly seven-fold modulation of the cubic lattice which is predicted by an observed phonon anomaly above T/sub M/. In the low-temperature 7R phase a nonuniform spacing of superlattice reflections and unusual line shapes are observed which are believed to arise from stacking faults.

19956 **First-principles study of the conduction-electron-mediated interactions between nuclear spins in copper metal.** Oja, A.S.; Wang, X.W.; Harmon, B.N. (Low Temperature Laboratory, Helsinki University of Technology, SF-02150 Espoo, Finland). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4009-4021(1 Mar 1989).

Motivated by recent success in observing the ordering of copper nuclei at very low temperatures, we have used first-principles electronic structure calculations to evaluate the conduction-electron-mediated coupling strengths between the nuclear spins. Scalar-relativistic wave functions from a self-consistent linear augmented-plane-wave calculation were used to evaluate the contact, dipolar, and orbital electron-nuclear interactions. Besides the isotropic Ruderman-Kittel coupling between nuclei, the electron-nuclear dipolar and orbital interactions give rise to significant anisotropic coupling terms. The symmetry of the anisotropic coupling is not dipolar in form and the significance of this for analysis of NMR line broadening is pointed out. The coupling strengths are in good agreement with various NMR measurements. Using mean-field theory, the overall coupling predicts an ordering wave vector at $(2\pi/a)(0.87,0,0)$ and a helical spin structure; however, this state is only 0.6% lower in energy than the state with ordering vector $(2\pi/a)(1,0,0)$, which is the one recently observed in neutron scattering experiments. The numerical calculations are not precise enough to accurately determine the ordering vector because of this extremely small difference in energy for states near the zone boundary along the (1,0,0) direction.

19957 **Analysis of small-angle scattering patterns from precipitating alloys.** Triolo, R.; Caponetti, E.; Spooner, S. (Istituto di Chimica Fisica Universita di Palermo, Via Archirafi 26, 90123 Palermo, Italy). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4588-4591(1 Mar 1989).

The structure of an alloy containing a high density of precipitate particles is analyzed with the Percus-Yevick hard-sphere model to represent the spatial arrangement of precipitates. A commercial aluminum-lithium alloy was heat treated to produce a structure containing a high density of nearly spherical precipitates having the nominal composition Al_5Li in a matrix of almost-pure aluminum. Small-angle x-ray scattering from foils of the alloy was analyzed by nonlinear fitting to a theoretical scattering curve based on a hard-sphere-liquid model which satisfactorily represented the particle size, particle-interaction distance, and particle density. Fitting the calibrated scattering cross section permits determination of the precipitate and matrix composition. While the Percus-Yevick model has been used in modeling micelle solution structures and liquids, this is the first known application to the structure of precipitate alloys.

19958 **Gutzwiller dynamic susceptibility: Consequences for the transport properties of transition metals.** Li, T.C.; Rasul, J.W. (National Research Council of Canada, Ottawa, Canada K1Achemical bond0R6). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4630-4633(1 Mar 1989).

We calculate the dynamic susceptibility chi(q,ω) of the Hubbard model using the boson representation of Kotliar and Ruckenstein. The energy and momentum dependence of chi(q,ω) are the same as in the random-phase approximation, but the Gutzwiller mass enhancement (m/sup *//m) and spin Landau parameter are included. Combining this with the Kaiser-Doniach expression for the resistivity rho/sup s/⁻/sup d/ of a transition metal we obtain a T^2 term in rho/sup s/⁻/sup d/ which scales with (m/sup *//m)^2 in accordance with experiment and has the correct magnitude.

19959 **Coexisting static magnetic order and superconductivity in CeCu/sub 2.1/Si_2 found by muon spin relaxation.** Uemura, Y.J.; Kossler, W.J.; Yu, X.H.; Schone, H.E.; Kempton, J.R.; Stronach, C.E.; Barth, S.; Gygax, F.N.; Hitti, B.; Schenck, A.; and others. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4726-4729(1 Mar 1989).

Zero- and longitudinal-field muon-spin-relaxation measurements on a heavy-fermion system CeCu/sub 2.1/Si_2 have revealed an onset of static magnetic ordering below T/sub M/ ~0.8 K, which coexists with superconductivity below T/sub C/ = 0.7 K. The line shapes of the observed muon spin depolarization functions suggest an ordering in either the spin-glass or incommensurate spin-density-wave states, with a small averaged static moment of the order of 0.1μ/sub B/ per formula unit at $T \rightarrow 0$.

19960 **Ferromagnetism in icosahedral Al-Mn-Si alloys.** Dunlap, R.A.; McHenry, M.E.; Srinivas, V.; Bahadur, D.; O'Handley, R.C. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4808-4811(1 Mar 1989).

Alloys of Al/sub 50/Mn/sub 20/Si/sub 30/ and Al/sub 55/ Mn/sub 20/Si/sub 25/ have been prepared by rapid quenching from the melt onto a single Cu roller. As-quenched alloys have been found to be fully amorphous. This amorphous phase crystallizes at approximately 600 K. Alloys annealed below the crystallization temperature transform into single-phase icosahedral quasicrystals. Both the amorphous and quasicrystalline phases are weakly ferromagnetic with Curie temperatures around 120 K and saturation magnetization in the order of 0.1 emu/g.

19961 **Apparatus for dendritic web growth systems.** Hundal, R.; Seidensticker, R.G.; McHugh, J.P. (to Dept. of Energy, Washington, DC). US Patent 4,786,479. 22 Nov 1988. Filed date 2 Sep 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an apparatus for growing dendritic web crystals comprising: a. a susceptor; b. a crucible for melting silicon, the crucible nesting within the susceptor; c. a sublid positioned above the susceptor and crucible, the sublid having upper and lower horizontal surfaces, the sublid further having a slot through which a dendritic web crystal may be pulled, the slot defining at least one inner surface in the sublid; d. a susceptor lid having an upper horizontal surface and a lower horizontal surface, the susceptor lid further having a slot through which a dendritic web crystal may be pulled, the susceptor lid further having a lip disposed downwardly from the susceptor lid lower horizontal surface, the lip extending continuously and peripherally around the susceptor lid slot and having an outer surface facing the inner surface of the sublid, the susceptor lid lower horizontal surface facing the sublid upper horizontal surface; e. the susceptor lid being positioned above the sublid such that the lip of the susceptor lid fits substantially concentrically within the sublid slot, and providing insulating space between the upper horizontal surface of the sublid and the lower horizontal surface of the susceptor lid and between the outer surface of the susceptor lid lip and the inner surface of the sublid.

19962 **Method and apparatus for removal of gaseous, liquid and particulate contaminants from molten metals.** Hobson, D.O.; Sikka, V.K. (to Dept. of Energy, Washington, DC). US Patent 4,786,320. 22 Nov 1988. Filed date 10 Aug 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a device for removing contaminants from a molten metal composition, the contaminants being characterized in having less electrical conductivity than the molen metal, comprising a body of toroidal configuration having an outer wall and a toroidal cavity, the toroidal body having inlet and outlet ends adapted to receive and discharge a stream of the molten metal composition and means for applying a magnetic field to the molten metal composition within the toroidal cavity which magnetic field simultaneously induces an electric current which flows perpendicular to the magnetic field so as to impose a force on the molten metal composition at right angles to a plane containing the magnetic field and current flow direction, thereby causing an increase in the apparent density of the molten metal component of the composition in the direction of the force while the contaminants contained in the composition move in a direction opposite to the imposed force.

19963 **(N—89-13514) Composition dependence of the M, temperature in the beta'NiAl compound.** Ochiai, S.; Ueno, M. Translated from *Nippon Kinzoku Gakkaishi ;* **52**: No. 2, 157-162(Sep 1988). 19p. (NASA-TT—20336; NAS—1.77:20336). NTIS, PC A03/MF A01.

Martensitic transformation start (M sub s) temperatures were measured for Ni-Al sintered alloys containing 36 to 38 at. percent Al by using an electric resistivity method. The composition dependence was investigated by using a statistical approach involving the Bragg-Williams approximation. A linear relation exists between M sub s temperature and Al content and has a slope of 160 K/at percent Al. There is no difference in composition dependence of the M sub s temperature between the sintered and cast alloys. The interaction parameter between Ni and Al atoms in the martensitic phase is estimated at -12.7 kJ/mol. The composition dependence is closely related to the interaction parameters in the parent and martensitic phases and temperature dependence of the differences in the Gibbs free energy of constituent elements between the A1(fcc) and A2(bcc) crystal structure.

19964 **The evolution of damage and fracture in iron compacts with various initial porosities.** Spitzig, W.A.; Smelser, R.E.; Richmond, O. (Ames Lab., Iowa State Univ., Ames, IA (US)). *Acta Metallurgica;* **36**: No. 5, 1201-1212(May 1988).

This study evaluated the tensile and compressive mechanical properties of iron compacts of various initial porosities, and determined the effect of deformation on the evolution of porosity, pore size and pore shape. The loss in flow strength with porosity was considerably greater than predicted by Gurson's constitutive model for ductile porous materials, but it was in substantial agreement with recent modifications of that model. The modified models also give good agreement with observed porosity growth with increasing deformation. Pore growth in the tensile direction was somewhat less than that predicted from a model based on an isolated spherical pore and pore growth in the transverse direction was somewhat greater than that predicted from such a model. These discrepancies are probably a consequence of pore interactions during deformation. Observations on fracture behavior in the iron compacts showed that a localization model based on a band imperfection gave good predictions of ductility when the imperfection had a porosity about one and one-half to two times that of the bulk porosity. Dirichlet cell analyses give direct evidence that regions containing local area fractions of porosity up to 4-7 times the bulk porosity are present in the different iron compacts. These regions, however, are not in the form of bands of indefinite extent, and it is evident that further progress on the effect of pore distribution on fracture requires a more detailed theory.

19965 **Effects of grain size and test temperature on ductility and fracture behavior of a b-doped Ni/sub 3/Al alloy.** Takeyama, M.; Liu, C.T. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Acta Metallurgica;* **36**: No. 5, 1241-1249(May 1988).

Effect of grain size on ductility and fracture behavior of boron-doped Ni/sub 3/Al(Ni-23Al-0.5Hf, at.%) was studied by tensile tests using a strain rate of 3.3 x 10/sup -3/s/sup -1/ at temperatures to 1000°C under a high vacuum of $<$ 1 x 10/sup -4/ Pa. At temperatures below 700°C, the alloy showed essentially ductile transgranular fracture with more than 30% elongation whereas it exhibited ductile grain-boundary fracture in the temperature range from 700 to 800°C. In both cases, the ductility was insensitive to grain size. On the other hand, at room temperatures above 800°C, the ductility decreased from about 17 to 0% with increasing grain size. The corresponding fracture mode changed from grain-boundary fracture with dynamic recrystallization to brittle grain-boundary fracture. The ductile transgranular fracture at lower temperatures is explained by stress concentration at the intersection of slip bands. The grain-size dependence of ductility is interpreted in terms of stress concentration at the grain boundaries. Finally, it is suggested that the temperature dependence of ductility in this alloy might be related to the thermal behavior of boron segregated to the grain boundaries.

19966 **Effects of neutron irradiation on Nd-Fe-B magnetic properties.** Cost, J.R.; Brown, R.D.; Giorgi, A.L.; Stanely, J.T. (Los Alamos National Labs., Los Alamos, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 3, 2016-2019(May 1988).

Nd-Fe-B permanent magnets from two different manufacturers were irradiated in the Omega West Reactor at Los Alamos National Laboratory, Los Alamos, NM, with fast neutrons at temperatures of 426 K (153°C) and 350 K (77°C) to fluences of 5.0 x 10/sup 16/ N/cm/sup 2/ and 6.1 x 10/sup 16/ N/cm/sup 2/, respectively. At intervals during the irradiation the samples were removed from the reactor and the remanence measured at room temperature. The initial loss of remanence for irradaition at 426 K was ten percent for a fluence of 10/sup 15/ N/cm/sup 2/. At 350 K the initial loss rate was roughly half this value. The loss rates were nearly the same for samples from the two different manufacturers. These losses are due to the irradiation since the remanence does not decay with annealing at 426 K. Remagnetization after irradiation results in full recovery of the remanence and roughly a 20-percent increase in the coercivity. Evidence from this experiment suggests that the primary mechanism for loss of remanence is nucleation of reverse domains by the collision cascade and subsequent growth into the original domain.

19967 **Influence of solute segregation on the dislocation structure of small and large angle [001] twist boundaries in Fe-Sb alloys.** Lin, C.H.; Sass, S.L. (Dept. of Materials Science and Engineering, Cornell Univ., Ithaca, NY (US)). *Scripta Metallurgica;* **22**: No. 5, 735-740(May 1988).

In alloy systems where there is limited solubility in the solid solution solute atoms segregate to grain boundaries giving local

compositions at the interface typically at the monolayer level. The practical consequence of such segregation in Fe-base alloys is frequently the embrittlement of the grain boundary region, making it susceptible to fracture at relatively low stresses. It is interesting to note that in polycrystalline Ni/sub 3/Al, which is intrinsically brittle, B segregation to grain boundaries and changes in stoichiometry, make the material ductile. It is of considerable importance to learn how the presence of solute changes the fracture resistance of grain boundaries. Briant and Messmer suggested that segregation causes a change in the nature of the electronic bonding at the interface, which is believed to influence its cohesive strength. Hart suggested that segregation causes a change in the structure of the boundary and in this manner controls its resistance to fracture. At present there is no experimental evidence concerning the bonding at grain boundaries in Fe-Te, and in Cu-Bi. Others have reported a characteristic grain boundary morphology in the presence of solute segregation, in the form of faceting. While both sets of observations lead to the suggestion that faceting results from solute segregation, neither study examined the structure of the same boundary in both the clean and segregated states.

19968 **Stress corrosion cracking of austenitic stainless steels in NaCl-AlCl/sub 3/ at 175C.** Smyrl, W.H. (Univ. of Minnesota, Corrosion Research Center, Minneapolis, MN (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

Austenitic stainless steels are susceptible to stress corrosion cracking in chloride media. A test that is often used to determine the susceptibility of a new alloy involves boiling aqueous MgCl/sub 2/ solutions. The compositions of the solution is not controlled in the tests, and changes as water is evaporated. The pH may change as well. Such poorly defined conditions make any mechanistic interpretation very tenuous, and the results may be tabulated as purely empirical data. the choice of the molten salt in the present investigation was made for two reasons. First, the studies could be carried in the molten salt media with the exclusion of H/sub 2/O. Second, the crack propagation could be investigated under well controlled electrochemical conditions. Therefore, the results may help to identify the controlling processes that occur during stress corrosion cracking, and the comparison to results in boiling MgCl/sub 2/ may help to reveal the controlling processes in that medium as well. Crack propagation has been studied for several nitronic stainless steels in the molten salt medium under controlled electrochemical potential conditions. The alloys were studied under fully austenitic conditions. The material was studied in the annealed and work hardened condition, and both were susceptible to cracking in the molten salt. The velocity of cracking was studied as a function of applied stress at several electrochemical potentials.

19969 **Corrosion of beryllium.** Mueller, J.J.; Adolphson, D.R. (Battelle Columbus Labs. (US)). pp v of Metals handbook ninth edition. Volume 13. Corrosion. Houston, TX; Gulf Publishing Company (1987).

The corrosion behavior of beryllium in aqueous and elevated-temperature oxidizing environments has been extensively studied for early-intended use of beryllium in nuclear reactors and in jet and rocket propulsion systems. Since that time, beryllium has been used as a structural material in les corrosive environments. Its primary applications include gyro systems, mirror and reentry vehicle structures, and aircraft brakes. Only a small amount of information has been published that is directly related to the evaluation of beryllium for service in the less severe or normal atmospheric environments associated with these applications. Despite the lack of published data on the corrosion of beryllium in atmospheric environments, much can be deduced about its corrosion behavior from studies of aqueous corrosion and the experiences of fabricators and users in applying, handling, processing, storing, and shipping beryllium components. The methods of corrosion protection implemented to resist water and high-temperature gaseous environments provide useful information on methods that can be applied to protect beryllium for service in future long-term structural applications.

19970 **Corrosion of uranium and uranium alloys.** Weirick, L.J. (Sandia National Labs. (US)). pp v of Metals handbook ninth edition. Volume 13. Corrosion. Houston, TX; Gulf Publishing Company (1987).

The corrosion of uranium and uranium alloys is reviewed in this article. Included are sections on the oxidation of unalloyed uranium, the effect of alloying elements on oxidation response, the corrosion behavior of uranium alloys in aqueous solutions, the influence of microstructure on corrosion properties of the alloys, galvanic behavior, the stress-corrosion cracking (SCC) of uranium alloys, and protective coatings for the uranium and uranium alloys, particularly metallic coatings of electroplated nickel and ion-plated aluminum.

19971 **Deuterium concentration and trapping effects in electrochemically charged Fe-Ni-Co alloys.** Moody, N.R.; Robinson, S.L.; Myers, S.M.; Greulich, F.A. (Sandia National Labs., Livermore, CA 94550, Albuquerque, NM (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

Recent studies on the iron-based superalloy IN903 show that hydrogen significantly degrades tensile ductility and crack growth resistance of this alloy at room temperature. Although the fracture modes associated with the degradation in properties are well-defined, the fracture mechanisms and the effect of hydrogen concnentration requires further definition. This involves determining if the microstructural features at which the cracks nucleate are trap sites and defining the relationship between trap-site and sample hydrogen concnetrations. Electrochemical charging and permeation techniques are convenient and frequently used to study hydrogen concentration and trapping effects near room temperature. However, hydrogen concentrations cannot be calculated from charging conditions; they must be measured. Deuterium may be substituted for hydrogen in electrochemical charging solutions and readily measured in samples by nuclear reaction analysis. Nuclear reaction analysis was used to measure deuterium concentrations in IN903, a γ strengthened Fe-Ni-Co superalloy, and Kovar a similar single phase Fe-Ni-Co alloys, The γ precipitates and matrix carbides in IN903, the small, isolated MnS inclusions in Kovar, and the grain boundaries and dislocations in both alloys are potential trap sites. Helium-3, with energies ranging from 0.3 to 2.5 MeV, was then accelerated into the sample which produced protons from the reaction D(/sup 3/He,p)/sup 4/ He. The proton yield was measured with a silicon barrier detector and converted to a deuterium concentration versus depth profile with a published deconvolution procedure.

19972 **Influence of radiation on material properties: ASTM 13th international symposium (Part II).** Garner, F.A.; Henager, C.H.; Igata, N. Philadelphia, PA; ASTM (1987). 789p. (CONF-860605—). ASTM, 1916 Race St., Philadelphia, PA 19103.

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

This book contains over 50 selections. Some of the titles are: Light-ion irradiation creep and hardening of model ferritic alloys; The ductile-to-brittle transition behavior of martensitic steels irradiated to 27 dpa; Hydrogen buildup in irradiated type 304 stainless steel; Irradiation embrittlement of advanced pressure vessel steels; and the effect of thermal annealing on the fracture properties of a submerged-arc weld metal.

19973 **(LA-tr—89-1) Study of the outgassing rates of materials at very low pressures.** Thibault, J.J.; Roussel, J.; Jourdan, M. Translated from *Vide ;* No. 132, 309-319(1967). Contract W-7405-ENG-36. 28p. (CONF-670638—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006104/JAW.

From International conference on ultra high vacuum; Paris, France (28 Jun 1967).

Few experiments have been done in order to measure the outgassing rates of materials in the ultra high vacuum range. This is the reason why we have been studying for three years the outgassing of stainless steel, copper and copper alloys, blackened copper,

in the 10/sup {minus}7/ to 10/sup {minus}10/ torr range for pumping times up to 200 hours. The measuring method used is the Oatley method. The data obtained are discussed through the use of Lagumuir's adsorption theory. 10 refs., 14 figs., 1 tab.

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REFER ALSO TO CITATION(S) 19178, 19211, 19563, 19847, 19850, 19870, 19921, 20063, 20101, 20157, 20193, 20239, 20239, 20256, 20256, 20332, 21382, 21387, 21389, 21534

19974 **(ANL/PPRNT—89-97) Peierls instability in the high-T/sub c/ superconductor La/sub 2-x/Ba/sub x/CuO_4.** Schuettler, H.B.; Jorgensen, J.D.; Hinks, D.G.; Capone D.W. II; Scalapino, D.J. (Argonne National Lab., IL (USA)). Jan 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008447/JAW.

Based on the results of crystallographic and transport measurements, we propose that the high-T/sub c/ superconductor La/sub 1.85/Ba/sub 0.15/CuO_4 is close to a Peierls 2k/sub F/-instability. The role of this instability in the high-T/sub c/ superconducting mechanism is discussed. 12 refs., 1 fig.

19975 **(ANL/PPRNT—89-147) High field magnetoresistance and de Haas-van Alphen effect in antiferromagnetic PrB_6 and NdB_6.** Onuki, Y.; Umezawa, A.; Kwok, W.K.; Crabtree, G.W.; Nishihara, M.; Yamazaki, T.; Omi, T.; Komatsubara, T. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 119p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008457/JAW.

The transport properties and the de Haas-van Alphen (dHvA) effect have been measured for antiferromagnetic PrB_6 and NdB_6. The number of conduction electrons is approximately one per unit cell. The magnetoresistance shows the existence of open orbits implying a multiply connected Fermi surface. The angular dependence of the magnetoresistance is roughly similar to that of the reference material, LaB_6. The dHvA data in PrB_6 shows both paramagnetic and antiferromagnetic Fermi surfaces. The antiferromagnetic Fermi surface arises from new magnetic Brillouin zone boundaries and antiferromagnetic gaps introduced by the magnetic order, and the paramagnetic Fermi surface from magnetic breakdown through the small antiferromagnetic gaps in high field. Hybridization between the conduction electrons and the f electrons has been observed through the cyclotron masses, which in PrB_6 are three times larger than the corresponding masses of LaB_6. In NdB_6 only the antiferromagnetic Fermi surface, quite different from those of LaB_6 and PrB_6, has been observed. 26 refs., 10 figs., 3 tabs.

19976 **(ANL/PPRNT—89-157) Electronic structure and properties of YBa_2Cu_3O/sub 7-δ/: A low dimensional, low density of states superconductor.** Massidda, S.; Yu, Jaejun; Freeman, A.J.; Koelling, D.D. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008456/JAW.

The electronic structure of the high T/sub c/ superconductor, YBa_2Cu_3O/sub 7-δ/, determined from highly precise all-electron local density calculations yields a relatively simple highly 2D electronic band structure consisting of two 2D Cu_2-O and two 1D Cu_1-O bands (one almost empty and one almost full at $\delta = 0$, becoming full at $\delta \geqq 0.1$) near E/sub F/. Detailed features (multipeaks) of the density of states (DOS) are correlated with the band structure of the 36 Cu-O band complex. Surprising features include: (i) the low DOS at E/sub F/, especially for $\delta \geqq 0.1$ which is much lower than that in La/sub 2-x/Sr/sub x/CuO_4 - in agreement with experiment - and (ii) a relatively large magnetic Stoner factor. 10 refs., 3 figs.

19977 **(ANL/PPRNT—89-166) Identification of precipitates in sintered Cr_2O_3-1.35 weight % Y_2O_3 polycrystals.** King, W.E.; Park, J.H. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008357/JAW.

The microstructure of sintered Cr_2O_3-Y_2O_3 alloys that have been used previously for cation diffusion studies has been investigated using electron microscopy. The sintered materials contained a second phase that was studied using electron diffraction and x-ray energy dispersive spectroscopy. Experimental diffraction patterns were compared to theoretically calculated patterns using digital image processing. 15 refs., 3 figs., 2 tabs.

19978 **(BNL—42180) Reaction between YBa_2Cu_3O/sub 7-x/ and water.** Ruckman, M.W.; Heald, S.M.; Di Marzio, D.; Chen, H.; Moodenbaugh, A.R.; Yang, C.Y. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-881002—46). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007046/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Reaction between water at 80{degree}C and YBa_2Cu_3O/sub 7-x/ ($0.8 < x < 0.0$) is studied using x-ray absorption fine structure (EXAFS) and x-ray diffraction (XRD). Oxygen deficient YBa_2Cu_3O/sub 7-x/ reacts with water and decomposes into $BaCO_3$, CuO and at least one other Cu containing phase. $YBa_2Cu_3O_7$ reacts slowly with water and the bulk material is modified before it decomposes. The structural chemical modifications of this material resemble those reports for $YBa_2Cu_3O_7$ reacted with hydrogen gas. We conclude that either hydrogen or water enters the bulk before decomposition. 14 refs., 4 figs.

19979 **(CEA-CONF—9478) Anisotropic electrical properties of superconducting single crystals YBa/sub 2/ Cu/sub 3/ O/sub 7-x/.** Konczykowski, M.; Rullier-Albenque, F.; Collin, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie; Paris-11 Univ., 91 -Orsay (FR)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie; Ecole Polytechnique, 91 - Palaiseau (France)). 1988. 2p. (CONF-880206—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756987/JAW.

From International conference on high temperature superconductors and materials and mechanisms of superconductivity; Interlaken, Switzerland (29 Feb 1988).

The effect of the hydrostatic pressure (up to 18 kbar) on the transport properties of YBa/sub 2/ Cu/sub 3/ O/sub 7/ single crystals was investigated. A decrease of the resistivity and of its anisotropy was observed under pressure whereas an increase of the critical temperature, of the upper critical field and of its slope vs temperature variation was found.

19980 **(CEA-CONF—9585) Moessbauer study of super and semi-conducting samples of /sup 57/ Fe-doped (La/sub 2-y/ Sr/sub y/) Cu0/sub 4-δ/.** Imbert, P.; Jehanno, G.; Hodges, J.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). 1988. 10p. (CONF-880845—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756988/JAW.

From Meeting on nuclear methods in magnetism; Munich, F.R. Germany (1 Aug 1988).

From Mossbauer and resistivity measurements on (La/sub 2-y/ Sr/sub y/) CuO/sub 4-δ/ samples doped with 5/1000 /sup 57/ Fe, three successive phases are observed depending on the y value: a semiconducting antiferromagnetic phase for $y < 0.02$; a semiconducting phase with two-dimensional spin-glass Cu magnetic order for $0.02 < y < 0.07$; and a superconducting phase for $y > 0.07$, where Cu (or Fe-induced) spin-glass order survives. For the highest y value ($y = 0.2$) this order is clearly governed by the iron impurities interacting through the Cu sublattice.

19981 **(CEA-tr—2317) Structural modifications of type C rare earth sesquioxyde Yb/sub 2/0/sub 3/ and Er/sub 2/0/sub 3/ in function of temperature.** Saiki, A.; Ishizawa, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1988. 13p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756998/JAW.

Monocrystal structure of Yb/sub 2/0/sub 3/ and Er/sub 2/ 0/sub 3/ is analyzed with a X-ray diffractometer from ambiant temperature to 1260 K and mean linear thermal dilatation coefficients of crystal network unit mesh are measured for both oxides. Relationship between oxygen atom pattern and oxygen-metal length and evolution with temperature are studied.

19982 **(CONF-881127—4) Metalorganic chemical vapor deposition of highly textured superconducting YBa_2Cu_3O/sub 7-x/ films.** Zhang, K.; Kwak, B.S.; Boyd, E.P.; Wright, A.C.; Erbil, A. (Georgia Inst. of Tech., Atlanta (USA). School of Physics). 1988. Contract FG05-86ER45266. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007221/JAW.

From Conference on the science and technology of thin film superconductors; Colorado Springs, CO, USA (14 Nov 1988).

C-axis textured single phase superconducting YBa_2Cu_3O/sub 7-x/ films have been successfully grown on the yttria-stabilized zirconia (100) substrates by using the metalorganic chemical vapor deposition technique. After the post annealing the films deposited on the yttria-stabilized zirconia substrates exhibited a highly textured x-ray pattern with c-axis perpendicular to the substrate surface. These films show an onset superconducting transition temperature of 93K with the resistance becoming zero at 84K. The films deposited on sapphire show a semiconducting feature in the normal state with a broad superconducting transition at much lower temperatures (10-40K). In order to gain some insight onto the growth process, we also studied the mass transport of metalorganic compounds as a function of source temperature, flow rate and reactor pressure. 15 refs., 10 figs.

19983 **(CONF-8810118—4) Hydrogen potential in β-V_2H studied by deep inelastic neutron scattering.** Hempelmann, R.; Price, D.L.; Reiter, G.; Richter, D. (Argonne National Lab., IL (USA)). Feb 1989. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007509/JAW.

From Workshop on momentum distributions; Argonne, IL, USA (24 Oct 1988).

Two complementary techniques of deep inelastic neutron scattering were used to study hydrogen in β-V_2H: (i) by means of neutron vibrational spectroscopy we measured hydrogen vibrations up to the fourteenth order; from these data we derived the effective single-particle potential, the shape of which is a parabola with a flattened bottom, and the hydrogen wave functions. (ii) By means of neutron Compton scattering we determined the kinetic of energy of the hydrogen; the value agrees with that calculated from the vibrational ground-state wave function. 6 refs., 5 figs.

19984 **(CONF-8810195—5) An in-situ, high-temperature study of the superconductor YBa/sub 1.67/Sr/sub 0.33/ Cu_3O/sub 6+X/.** Faber, J. Jr.; Shaked, H.; Veal, B.W.; Hitterman, R.L.; Paulikas, A.P.; Nowicki, L.J.; Downey, J.W. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007375/JAW.

From 41. Pacific coast regional meet of American Ceramic Society; San Francisco, CA, USA (24 Oct 1988).

Neutron diffraction is a powerful scientific probe for the study of ceramic materials. Perhaps the most interesting structural studies of ceramics involve analyzing property behavior under in-situ conditions. This technique has been used to study the High-T/ sub c/, Sr-doped 123 material, YBa/sub 1.67/Sr/sub 0.33/Cu_3O/sub 6+x/ at high temperature. An order-disorder transition is observed at T = 650C. Upon heating, the crystal symmetry changes from orthorhombic (Pmmm) below the transition to tetragonal (P4/ mmm) above. The mechanism of the phase transition involves the redistribution of anions on the O(1) and O(5) sites. These sites become equivalent in the high temperature phase. In addition, the anions on these lattice sites do not exhibit temperature-dependent thermal vibration behavior, indicating that this behavior is dominated by static displacements due to nonstoichiometric disorder. 18 refs., 5 figs.

19985 **(CONF-8810292—1) Pre-pilot synthesis of low carbon Si_3N_4.** Crosbie, G.M.; Nicholson, J.M.; Predmesky, R.L.; Stiles, E.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007202/ JAW.

From 2. international conference on ceramic powder processing science; Berchtesgaden, F.R. Germany (1 Oct 1988).

Of interest to present powder needs is a silicon nitride powder of high cation and anion purity without carbon residues. As part of the US Ceramic Technology for Advanced Heat Engines (CTAHE) program, this process study is directed toward pressurized reactions of $SiCl_4$ (vapor and liquid) with liquid NH_3 without organics. In the vapor chloride process, we observed that the cooling from latent heat of vaporization of NH_3 more than offsets the heat of reaction at 0{degree}C and 0.6 MPa. Crystallites of 0.2 to 0.3 μm size and of primarily equi-axed shapes were found. In the present phase, our goal is to test for unique properties of the ceramics sintered from larger quantities of the low carbon powders. For this, we have installed a pre-pilot plant at 4 L scale and have shown rapid chloride by-product removal. 5 refs., 3 figs.

19986 **(CRIE-T—87120) Evaluation test of ceramics fracture strength under tension-compression cyclic loading at ultra-high temperature.** Nitta, Akihito; Ogata, Takashi; Fujioka, Terutaka. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1988. 31p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756460/JAW.

Ceramics are expected from their excellent corrosion-resistance and high-temperature strength to be applicable to ultra-high temperature structures such as gas turbine components. For the purpose, it is necessary to establish a technology of testing and evaluating ceramics as a structural material. However, ceramics testing is very difficult in general because of their brittleness. Prior to practical use of ceramics as an ultra-high temperature structural material, ultra-high temperature tension-compression fatigue testing technique which are the most difficult for ceramics has been developed in cooperation with testing machine manufacturers as one of testing and evaluating technologies to be the basis. And the rigidity of the whole testing machine was improved and an advanced specimen grip type was established. Fatigue tests were carried out at 1300°C on a silicon carbide by using the testing machines developed. From the test results, the techniques were found to have sufficient accuracy and reliability for the ceramics fatigue tests. (20 figs, 5 tabs, 9 refs)

19987 **(DOE/CE/90001—2) The joint effect of surface microtopography and near-surface structure on microcontact conditions: Progress report for period June--August 1988.** McCool, J.I.; Bunting, B.G. (MRC Bearings, Jamestown, NY (USA)). Nov 1988. Contract AC02-87CE90001. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008515/JAW.

A data base of roughness measurements has been compiled for the ceramic test specimens to be wear tested in this program. The computation of the equivalent isotropic RMS profile slope is discussed and numerical values are given. Wear tests performed on AlO, SiN, and SiC at ORNL show significant differences in wear coefficient due to both material and finish. Acoustic emission readings reflective of variations in the porosity and/or elastic modulus at near surface layers were performed on three differently finished silicon nitride flats, at the Argonne National Laboratory. The within specimen variability is believed to indicate real differences from location to location within a specimen. There is no apparent difference between specimens. An alternative procedure for characterizing variations in elastic modulus using a nanoindenter is discussed. 4 refs., 4 tabs.

19988 **(DOE/ER/45170—5) Theoretical studies on the electronic structure and properties of complex ceramic crystals and glasses: Annual progress report, July 1, 1988--June 30, 1989.** Ching, Wai-Yim. (Missouri Univ., Kansas City, MO (USA)). 10 Jan 1989. Contract FG02-84ER45170. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008637/JAW.

This is the second year in the study of electronic and structural properties of complex ceramic crystals and glasses by means of large scale theoretical calculations. Accomplishments covered in this report are: (1) Study of electronic structures and optical properties of some newly discovered layered superconducting oxides; (2) Formulation of excitonic enhancement model for high T/sub c/ superconductivity and stoichiometric interpretation of structures of superconducting oxides; (3) Study of ground-state properties and phase transitions in Si; (4) First-principles calculation of crystal field parameters and zero temperature anisotropic energy in $Nd_2Fe_{14}B$ permanent magnet; and (5) First-principles calculation of electronic structure and transport properties in metallic glasses. 9 refs.

19989 **(IFTM-CS—11-1987) Preparation and properties of high-temperature superconductors in the Y-Ba-Cu-O system.** Miu, L.; Popa, S.; Popescu, M.; Cruceanu, E. (Central Inst. of Physics, Bucharest (Romania). Inst. for Physics and Technology of Materials). Apr 1987. 5p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706050/JAW.

Some experimental results concerning the synthesis of high-temperature superconducting materials in the Y-Ba-Cu-O system and their electrical, magnetic and structural properties are presented. (authors).

19990 **(IFTM-CS—13-1987) Influence of the preparation conditions on the diamagnetic response of high-Tsub(c) YBa/sub 2/Cu/sub 3/Osub(x) superconductor.** Miu, L.; Popa, S.; Popescu, M.; Pavel, E. (Central Inst. of Physics, Bucharest (Romania). Inst. for Physics and Technology of Materials). Nov 1987. 5p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706051/JAW.

Prolonged treatments in oxygen lead to a substantial increase of the diamagnetic signal of superconducting YBa/sub 2/Cu/sub 3/Osub(x) due to the decrease of the amount of defects and to the development of Josephson-like contacts between homogenous superconducting regions in the sample. The superconducting-glass features are expected to be considerably reduced in well crystallized samples at least at liquid nitrogen temperature. (authors).

19991 (INIS-SU—71, pp 9-11) **Anomalous behaviour of YBa/sub 2/Cu/sub 3/O/sub 7-x/ crystal lattice in the 40-300 K range.** Aleksandrov, O.V.; Ivanenko, O.M.; Karasik, V.R.; Kiseleva, K.V.; Mitsen, K.V.; Omel'yanovskij, O.E. 1988. (In Russian). NTIS (US Sales Only), PC A03/MF A01; INIS. Order Number DE89780069/JAW.

Kratkie soobshcheniya po fizike.; no. 4.

In Experimental and theoretical physics. Collection.

Using the X-ray diffraction methods for the first time it is established that in the 160-170 K temperature range there occurs phase transformation of the second order in YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconducting material. It is shown that the nature of structural anomaly at 100-110 K is not caused by rearrangement of vacancies of the oxygen sublattice of material. 9 refs.; 3 figs.

19992 **(KFK—4409) Improvements in the properties of NbN layers through the presence of small amounts of aluminum during sputtering.** Haase, E.L.; Ruzicka, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik). Sep 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756963/JAW.

Pure phase B1 NbN layers could be sputtered in our laboratory only with a maximum T/sub c/ of 15.9 K and a residual resistance ratio RRR of <0.9. Samples with a T/sub c/ of up to 16.7 K invariably had a large fraction of hexagonal foreign phase. If under similar conditions one sputters layers in the presence of small amounts of Al, one obtains pure B1 phase NbN layers with a maximum T/sub c/ of 16.9 K. The RRR rises to values of up to 1.16. The specific resistance drops from typical values of around 400 $\mu\Omega$cm to values as low as 73 $\mu\Omega$cm. The width of the X-ray lines drops occasionally, indicating increased grain size. Al acts like a catalyst, being substituted with less than 0.03 at% for a high T/sub c/ layer. When Al is substituted for Nb in detectable quantities both T/sub c/ and the lattice parameter drop. To verify the above results the experiment was repeated in a magnetron rather than a RF sputter system with similar outcome.

19993 **(KFK—4479) Determination of the optical constants of liquid UO/sub 2/ in the near infrared at 1064 nm.** Bober, M.; Singer, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1988. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756966/JAW.

The optical constants of liquid UO/sub 2/, n and k, were determined from reflexion measurements at the wave-length 1064 nm in the near infrared. The reflectivities of the specimen surfaces were measured with polarized light in a pressurized integrating sphere laser reflectometer and the respective values of the refractive index, n, and the absorption constant, k, of the specimen material were calculated. Consistent values resulted in the temperature range 3120-4000 K with only little dependence on the temperature. Mean values are $n = 2.0$ and $k = 0.51$ in this range.

19994 **(LA-UR—89-533) Microwave sintering of titanium diboride.** Katz, J.D.; Blake, R.D.; Scherer, C.P. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 24p. (CONF-890130—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007988/JAW.

From 13. annual conference on composites and advanced ceramics; Cocoa Beach, FL, USA (15 Jan 1989).

Titanium diboride was heated to high temperatures using microwaves. The highest temperature obtained was 2245{degree}C. Unfortunately, oxidation was a problem, especially at the higher temperatures, although an argon flush and a carbon getter were used. To completely stop oxidation, the oxygen potential must be below 10/sup {minus}18/ atmospheres. Using an argon flush and a carbon getter, titanium diboride was successfully densified to 82% of theoretical without measurable oxidation by heating with microwaves to 1860{degree}C. Density actually decreased upon reaching temperatures above 1860{degree}C due to void formation adjacent to the surface. Void formation is thought to be due to the formation of B_2O_3(g) which evolves rapidly above 1860{degree}C because of the loss of a TiO_2 protective film which melts at this temperature. 9 refs., 12 figs., 2 tabs.

19995 **(LBL—26235) Low frequency resistance fluctuations in films of high temperature superconductors.** Rosenthal, P.; Hammond, R.H.; Beasley, M.R.; Leoni, R.; Lerch, P.; Clarke, J. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 5p. (CONF-880812—41). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007489/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Low frequency voltage fluctuations in thin films of YBa_2Cu_3O/sub 7-x/ at and above the superconducting transition have a spectral density S/sub v/(f) proportional to {bar V}^{2}/f, where {bar V} is the average voltage across the film and f is the frequency. The value of S/sub v/(f)/{bar V}^{2} decreases markedly as the microstructure of the films is improved. In contrast to classic superconductors, the noise at the resistive transition does not arise from equilibrium temperature fluctuations. 9 refs., 4 figs.

19996 **(LBL—26519) The formation of barium titanate ceramics by solid state reaction.** Bierach, J.W. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008167/JAW.

The objective is to investigate the existence of secondary phases between the reactants BaO and TiO_2 during the formation of barium titanate ceramics. The reaction between $BaTiO_3$ and TiO_2 was studied at 1050{degree}C. This temperature was selected because it was near temperatures used in work in the literature and because, when produced for practical applications, barium titanate ceramics are often pre-reacted at 1050--1100{degree}C before being fired at temperatures greater than 1300{degree}C. The compositions and relative amounts of phases formed as a function of time at 1050{degree}C were identified by x-ray diffraction. The method of analysis increases the sensitivity with which phases can be detected over those of past studies, but it is emphasized that absence of x-ray diffraction evidence does not prove that a phase has not formed; the phase might be present in an amount below the detection limit for that phase. 33 refs., 17 figs., 8 tabs.

19997 (N—89-13642, pp 59-76) **Microstructural aspects of zirconia thermal barrier coatings.** Mitchell, T.E.; Suhr, D.S.; Keller, R.J.; Lanteri, V.; Heuer, A.H. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Various combination of plasma-sprayed bond coatings and zirconia ceramic coatings on a nickel-based superalloy substrate were tested by static thermal exposure at 1200 C and cyclic thermal exposure to 1000 C. The bond coats were based on Ni-Cr-Al alloys with additions of rare earth elements and Si. The ceramic coats were various ZrO2-Y2O3 compositions, of which the optimum was found to be ZrO2-8.9 wt percent Y2O3. Microstructural analysis showed that resistance to cracking during thermal exposure is strongly related to deleterious phase changes. Zones depleted of Al formed at the bond coat/ceramic coat interface due to oxidation and at the bond coat/substrate interface due to interdiffusion, leading eventually to breakdown of the bond coat. The 8.9 percent Y2O3 coating performed best because the as-sprayed metastable tetragonal phase converted slowly into the low-Y2O3 tetragonal plus high-Y2O3 cubic-phase mixture, so that the deleterious monoclinic phase was inhibited from forming. Failure appeared to start with the formation of circumferential cracks in the zirconia, probably due to compressive stresses during cooling, followed by the formation of radial cracks due to tensile stresses during heating. Cracks appeared to initiate at the Al2O3 scale/bond coat interface and propagate through the zirconia coating. Comparisons were made with the behavior of bulk ZrO2-Y2O3 and the relationship between the microstructure of the tetragonal phase and the phase diagram. A separate investigation was also made of the ZrO2-Al2O3 interface.

19998 (N—89-13642, pp 85-93) **Ceramic oxide reactions with V_2O_5 and SO_3.** Jones, R.L.; Williams, C.E. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Ceramic oxides are not inert in combustion environments, but can react with, inter alia, SO_3, and Na_2SO_4 to yield low melting mixed sulfate eutectics, and with vanadium compounds to produce vanadates. Assuming ceramic degradation to become severe only when molten phases are generated in the surface salt (as found for metallic hot corrosion), the reactivity of ceramic oxides can be quantified by determining the SO_3 partial pressure necessary for molten mixed sulfate formation with Na_2SO_3. Vanadium pentoxide is an acidic oxide that reacts with Na_2O, SO_3, and the different ceramic oxides in a series of Lux-Flood type of acid-base displacement reactions. To elucidate the various possible vanadium compound-ceramic oxide interactions, a study was made of the reactions of a matrix involving, on the one axis, ceramix oxides of increasing acidity, and on the other axis, vanadium compounds of increasing acidity. Resistance to vanadium compound reaction increased as the oxide acidity increased. Oxides more acidic than ZrO_2 displaced V_2O_5. Examination of Y_2O_3- and CeO_2-stabilized ZrO_2 sintered ceramics which were degraded in 700 C $NaVO_3$ has shown good agreement with the reactions predicted above, except that the CeO_2-ZrO_2 ceramic appears to be inexplicably degraded by $NaVO_3$.

19999 (N—89-13642, pp 95-109) **Destabilization of yttria-stabilized zirconia induced by molten sodium vanadate-sodium sulfate melts.** Nagelberg, A.S.; Hamilton, J.C. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The extent of surface destabilization of ZrO_2 - 8 wt percent Y_2O_3 ceramic disks was determined after exposure to molten salt mixtures of sodium sulfate containing up to 15 mole percent sodium metavanadate ($NaVO_3$) at 1173 K. The ceramic surface was observed to transform from the cubic/tetragonal to monoclinic phase, concurrent with chemical changes in the molten salt layer in contact with the ceramic. Significant attack rates were observed in both pure sulfate and metavanadate sulfate melts. The rate of attack was found to be quite sensitive to the mole fraction of vanadate in the molten salt solution and the partial pressure of sulfur trioxide in equilibrium with the salt melt. The observed parabolic rate of attack is interpreted to be caused by a reaction controlled by diffusion in the salt that penetrates into the porous layer formed by the destabilization. The parabolic rate constant in mixed sodium metavanadate - sodium sulfate melts was found to be proportional to the SO_3 partial pressure and the square of the metavanadate concentration. In-situ Raman spectroscopic measurements allowed simultaneous observations of the ceramic phases and salt chemistry during the attack process.

20000 (N—89-13642, pp 127-137) **Examination of coating failure by acoustic emission.** Berndt, C.C. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Coatings of NiCrAlY bond coat with a zirconia - 12 wt percent yttria overlay were applied to disc-shaped specimens of U-700 alloy. A waveguide of 1 mm diameter platinum was TIG welded to the specimen and allowed it to be suspended in a tubular furnace. The specimen was thermally cycled to 1150 C, and the acoustic emission (AE) monitored. The weight gain per thermal cycle was also measured. A computer system based on the IBM-XT microcomputer was used extensively to acquire the AE data with respect to temperature. This system also controlled the temperature by using a PD software loop. Several different types of AE analyses were performed. A major feature of these tests, not addressed by previous work in this area, was that the coatings covered 100 percent of the specimen and also that the AE was amplified at two different levels. It is believed that this latter feature allows a qualitative appraisal of the relative number of cracks per AE event. The difference in AE counts between the two channels is proportional to the number of cracks per AE event, and this parameter may be thought of as the crack density. The ratio of the AE count difference to the AE count magnitude of one channel is inversely proportional to the crack growth. Both of these parameters allow the crack distribution and crack growth within each specimen to be qualitatively followed during the thermal cycling operation. Recent results which used these principles will be presented.

20001 (N—89-13642, pp 155-165) **Characterization of ZrO_2-Y_2O_3 thermal spray powder systems.** Mantkowski, T.E.; Rigney, D.V.; Froning, M.J.; Jayaraman, N. (Cincinnati Univ., OH (USA)). 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The overall objective is to establish the interrelation between the raw material in the coating process and the performance of the coating deposit. It is anticipated that these interrelations will help establish more precise specifications for the procurement of the raw materials. Some of the preliminary results of the program are presented.

20002 (N—89-13642, pp 171-178) **Advanced thermal barrier coating systems.** Dorfman, M.R.; Reardon, J.D. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Current state-of-the-art thermal barrier coating (TBC) systems consist of partially stabilized zirconia coatings plasma sprayed over a MCrAlY bond coat. Although these systems have excellent thermal shock properties, they have shown themselves to be deficient for a number of diesel and aircraft applications. Two ternary ceramic plasma coatings are discussed with respect to their possible use in TBC systems. Zirconia-ceria-yttria (ZCY) coatings were developed with low thermal conductivities, good thermal shock resistance and improved resistance to vanadium containing environments, when compared to the baseline yttria stabilized zirconia (YSZ) coatings. In addition, dense zirconia-titania-yttria (ZTY) coatings were developed with particle erosion resistance exceeding conventional stabilized zirconia coatings. Both coatings were evaluated in conjunction with a NiCr-Al-Co-Y_2O_3 bond coat. Also, multilayer or hybrid coatings consisting of the bond coat with subsequent coatings of zirconia-ceria-yttria and zirconia-titania-yttria were evaluated. These coatings combine the enhanced performance characteristics of ZCY with the improved erosion resistance of ZTY coatings. Improvement in the erosion resistance of the TBC system should result in a more consistent delta T gradient during service. Economically, this may also translate into increased component life simply because the coating lasts longer.

20003 (N—89-13642, pp 203-209) **Cyclic stress analysis of ceramic coated gas turbine seals.** Padovan, J.; Dougherty, D.; Hendricks, B. (General Tire and Rubber Co., Akron, OH (USA)). 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Through the use of the Finite Element Method, the cyclic thermomechanical response of ceramic coated gas turbine parts is considered. The analysis includes temperature dependent elastic-plastic-creep material properties and cyclic thermal loads. To demonstrate the cyclic thermomechanical response, a ceramic coated outer gas path seal is studied. The analysis will estimate the significant residual stress field created by the cyclic thermal loads.

20004 (N—89-13642, pp 211-217) **Fabrication of strain-isolated ceramic coated combustor components.** Rutter, S. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The use of strain-isolated ceramic coated material to produce an AGT1500 combustor scroll-shaped transition duct which requires no air for film cooling is investigated. The scroll receives the exhaust of the can-style combustor liner and turns it into the annular inlet of the high pressure gas producer turbine nozzle. Strain-isolation of plasma sprayed thermal barrier coating is achieved by placing a compliant pad between the structural base metal and the ceramic coating. The compliant pad is brazed to the metal structure. In order to achieve a good braze bond, the strain-isolating compliant pad and base metal must be closely matched in shape and tightly fixtured for joining. The complex geometry of the AGT1500 scroll makes it impractical to attack pads to the supporting structure in its finished shape. Instead the pads are brazed to flat stock and post-formed into scroll sections. While test samples were successfully post-formed, plasma sprayed, and subjected to cyclic heating, the forming of full scale parts by normal methods resulted in tearing of the Hastelloy-X base metal because of embrittlement by the braze material. Several solutions were explored which finally resulted in the successful forming of full scale scroll parts.

20005 (N—89-13642, pp 219-225) **Strain isolated ceramic coatings.** Tolokan, R.P.; Brady, J.B.; Jarrabet, G.P. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Plasma sprayed ceramic coatings are used in gas turbine engines to improve component temperature capability and cooling air efficiency. A compliant metal fiber strain isolator between a plasma sprayed ceramic coating and a metal substrate improves ceramic durability while allowing thicker coatings for better insulation. Development of strain isolated coatings has concentrated on design and fabrication of coatings and coating evaluation via thermal shock testing. In thermal shock testing, five types of failure are possible: buckling failure im compression on heat up, bimetal type failure, isothermal expansion mismatch failure, mudflat cracking during cool down, and long term fatigue. A primary failure mode for thermally cycled coatings is designated bimetal type failure. Bimetal failure is tensile failure in the ceramic near the ceramic-metal interface. One of the significant benefits of the strain isolator is an insulating layer protecting the metal substrate from heat deformation and thereby preventing bimetal type failure.

20006 (N—89-13666) **High-strength silicon carbides by hot isostatic pressing.** Dutta, S. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 19p. (NASA-TM—101400; E—4484; NAS—1.15:101400; CONF-881125—). NTIS, PC A03/MF A01.

From 3. international symposium on ceramic materials and components for engines; Las Vegas, NV, USA (27 Nov 1988).

Silicon carbide has strong potential for heat engine hardware and other high-temperature applications because of its low density, good strength, high oxidation resistance, and good high-temperature creep resistance. Hot isostatic pressing (HIP) was used for producing alpha and beta silicon carbide (SiC) bodies with near-theoretical density, ultrafine grain size, and high strength at processing temperatures of 1900 to 2000 C. The HIPed materials exhibited ultrafine grain size. Furthermore, no phase transformation from beta to alpha was observed in HIPed beta-SiC. Both materials exhibited very high average flexural strength. It was also shown that alpha-SiC bodies without any sintering aids, when HIPed to high final density, can exhibit very high strength. Fracture toughness K (sub C) values were determined to be 3.6 to 4.0 MPa m (sup 1/2) for HIPed alpha-SiC and 3.7 to 4.1 MPa m (sup 1/2) for HIPed beta-SiC. In the HIPed specimens strength-controlling flaws were typically surface related. In spite of improvements in material properties such as strength and fracture toughness by elimination of the larger strength-limiting flaws and by grain size refinement, HIPing has no effect on the Weibull modulus.

20007 (N—89-14310) **Stability of bulk $Ba_2YCu_3O(7-x)$ in a variety of environments.** Gaier, J.R.; Hepp, A.F.; Curtis, H.B.; Schupp, D.A.; Hambourger, P.D.; Blue, J.W. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Dec 1988. 13p. (NASA-TM—101401; E—4485; NAS—1.15:101401; CONF-881155—). NTIS, PC A03/MF A01.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Small bars of ceramic Ba2YCu3O(7-x) were fabricated and subjected to environments similar to those that might be encountered during some NASA missions. These conditions include ambient conditions, high humidity, vacuum, and high fluences of electrons and protrons. The normal state resistivity or critical current density (J sub c) were monitored during these tests to assess the stability of the material. When normal state resistivity is used as a criterion, the ambient stability of these samples was relatively good, exhibiting only a 2 percent degradation over a 3 month period. The humidity stability was shown to be very poor, and to be a steep function of temperature. Samples stored at 50 C for 40 min increased in normal state resistivity by four orders of magnitude. Kinetic analysis indicates that the degradation reaction is second order with water vapor concentration. It is suspected that humidity degradation also accounts for the ambient instability. The samples were stable to vacuum over a period of at least 3 months. Degradation of J sub c in a 1 MeV electron fluence of 9.7 x 10 to the 14th e(-)/sq cm was determined to be no more than about 2 percent. Degradation of J sub c in a 8.7 x 10 to the 14th p(+)/sq cm of 42 MeV protons was found to be grain size dependent. Samples with smaller grain size and initial J sub c of about 240 A/sq cm showed no degradation. while that with larger grain size and an initial J sub c of about 30 A/sq cm degraded to 37 percent of its original value.

20008 **(PNL-SA—16305) Construction and testing of advanced ceramic fabric radiator components.** Antoniak, Z.I.; Webb, B.J. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 16p. (CONF-890103—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007239/JAW.

From 6. symposium on space nuclear power systems; Albuquerque, NM, USA (9 Jan 1989).

For a number of years, we have been studying the application of advanced ceramic fabric materials to spacecraft heat rejection systems. Our studies indicated that significant mass and launch volume savings could be realized through such application, but concrete evidence to support this contention was lacking. Recently, we have performed tests that support our claims. Test results demonstrate that thin (about 130 μm) fabric tubes lined with metal foil can sustain pressures to 3 MPa. Even more intriguing are the results of heat transfer measurements. Although several of the ceramic fabrics exhibit promising optical properties, these would require considerable improvement if transmission of radiant energy from the metal foil through the fabrics were to be the chief heat rejection mechanism. Instead, we have found that a complex combination of conduction and radiation-absorption-reradiation mechanisms, which are poorly understood yet, achieves an effective emittance of about 0.7. That is, a ceramic fabric material such as aluminoborosilicate, which is normally considered a thermal insulator, acts as a moderate-emittance coating on the metal foil. 3 refs., 4 figs., 3 tabs.

20009 **(SAND—88-1730C) Catalytic oxidation of silicon nitride thin films using potassium.** Rogers, J.W. Jr.; Blair, D.S.; Peden, C.H.F. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 2p. (CONF-881155—46). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007146/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Thin silicon nitride films on a Si(100) substrate have been oxidized using potassium in a low thermal budget process. The presence of potassium on the Si_3N_4 surface greatly lowers the temperature-time requirements for oxidation as compared with direct thermal oxidation. 6 refs., 1 fig.

20010 **Single-crystal YBa_2Cu_3O/sub 7-//sub x/ and Bi_2Ca/sub 1+//sub x/Sr/sub 2-//sub x/Cu_2O/sub 8+//sub y/ surfaces and Ag adatom-induced modification.** Meyer III, H.M.; Hill, D.M.; Wagener, T.J.; Weaver, J.H.; Gallo, C.F.; Goretta, K.C. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Applied Physics;* **65**: No. 8, 3130-3135(15 Apr 1989).

Comparison of x-ray photoemission results for single crystal and polycrystalline YBa_2Cu_3O/sub 7-//sub x/ allows us to identify oxygen vacancies in the Cu-O chains and determine their effects on the Cu, Ba, and Y core level line shapes. The deposition of adatoms of Ag onto single crystals of YBa_2Cu_3O/sub 7-//sub x/ and Bi_2Ca/sub 1+//sub x/Sr/sub 2-//sub x/Cu_2O/sub 8+//sub y/ leads to changes in the Cu $2p_3$/sub //$_2$ emission indicative of slight Cu^{2+} to Cu^{1+} surface reduction, with greater modification for the 1-2-3's than the 2-1-2-2's. O 1s core level results show Ag-induced broadening because of these surface effects. The Ba 3d and Y 3d structures showed minimal changes for the 1-2-3 surface. Ag deposition onto the 2-1-2-2 samples also leads to Bi dissociation and subsequent surface segregation.

20011 **Spall due to short high-intensity impulses.** Froeschner, K.E.; Maiden, D.E.; Chau, H.H. (Martin, Froeschner & Associates, Livermore, California 94550). *Journal of Applied Physics;* **65**: No. 8, 2964-2973(15 Apr 1989).

Spallation thresholds for (3)/(16) — (3)/(8) -in. 6061-T6, 5456, and 1100 aluminum and 6A14V titanium alloys were determined for impulses from 5 to 30 ktap with a pulse duration of 0.15 μs. These experiments show that for aluminum alloys the spall fracture stress is nearly a constant but varies between 16 and 20 kbar in different batches of material and shows suggestion of a weak dependence on strain rate with strain rates from 0.04 to 0.4 μs/sup -1/ . The impulse threshold for spall was 7.5 ktap. For 6A14V titanium the spall fracture stress was 60 kbar and the impulse threshold was 15 ktap. The stress pulses were produced by impacting target samples with a 0.012-in. (0.305 mm) thick by 3-in. (76 mm) square Kapton impactor projectile at velocities ranging from 0.13 to 0.44 cm/μs. Data obtained include detailed records of the impactor and rear (spalled) surface velocity versus time measured with a dual-beam Fabry—Perot interferometer, as well as soft recovery of the target residual and spall fragments. From these we are able to determine the partitioning of impulse between the target residual and the spall fragment(s) and the critical spall fracture stress and strain rate. We have also made microphotographic inspections and measured the stress-strain properties of recovered target. The data show that the amount of impulse (momentum per unit area) absorbed by a structural wall by a short duration pulse is limited by the spall threshold. Increases in applied impulse above this spall threshold result in higher spall fragment velocities but no apparent increase in the impulse delivered to the residual structure. Spall is thus an effective damage limiting mechanism which must be considered when estimating the effectiveness of systems whose primary damage is structural collapse due to impulse generated by short duration pulses.

20012 **Mechanical and high-temperature (920 °C) magnetic field grain alignment of polycrystalline (Ho,Y)Ba_2Cu_3O/sub 7-//sub δ/.** Lusnikov, A.; Miller, L.L.; McCallum, R.W.; Mitra, S.; Lee, W.C.; Johnston, D.C. (Ames Laboratory (USDOE), Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **65**: No. 8, 3136-3141(15 Apr 1989).

The effects of uniaxial compression, high-temperature (920 °C) heat treatment, and heat treatment plus magnetic field on grain alignment in bulk ceramic pellets of $HoBa_2Cu_3O$/sub 7-//sub δ/ and YBa_2Cu_3O/sub 7-//sub δ/ were studied and separated. Uniaxially cold pressing prereacted powder into pellets at room temperature is found to yield significant grain alignment on the flat end surfaces of the pellets perpendicular to the pressing axis, where the c axes of the grains are parallel to this axis, in agreement with previous reports. A simple method to quantitatively determine the degree of surface grain alignment from the powder x-ray diffraction data from these surfaces is used. These data were augmented by x-ray rocking curve measurements. The degree of alignment of the cold pressed samples was found to increase with increasing pressure up to our pressure limit of 310 MPa. However, bulk magnetization anisotropy measurements on these pellets indicate that the degree of bulk alignment is only about 1/3 to 1/2 that inferred from the above surface measurements, which in turn suggests that the degree of alignment decreases with distance from the flat end surfaces. We find that a pronounced additional surface grain alignment is produced by heat treating the cold-pressed samples at high temperature (920 °C). We also observed a significant influence during the high-temperature annealing of a small (0.7 T) applied magnetic field on the alignment of the surface grains. A model to explain these observations is presented and discussed.

20013 **Exchange dynamics of ^{23}Na and structural incommensuration in $NaMo_4O_6$: Dynamic line shape for the second order central transition of quadrupolar nuclei.** Chu, P.J.; Gerstein, B.C. (Institute for Physical Research and Technology, and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **90**: No. 7, 3713-3727(1 Apr 1989).

Sodium nuclei in $NaMo_4O$ exhibit motion as evidenced by the change in asymmetry parameter describing the central transition of ^{23}Na with variable temperature. The nonaxially symmetric electric field gradient observed in the slow motion limit implies that the preferred occupation of the sodium nucleus is not at the center of the tetragonal oxygen cage. At room temperature the sodium jumps randomly within the cage in such a manner as to experience an axially symmetric electric field gradient on average. Dynamic NMR line shape simulations invoking second order broadening of the central transition were performed based on models of four site exchange, and all-site random exchange. Both models yield results indistinguishable from experiment, with an activation energy E/sub a/ of 1.95 k cal mol^{-1}. An anomolous upfield shoulder in the central transition is related to the existence of a structural incommensuration. A lower transition temperature T/sub c/ = 140 K is evi-

denced by jump discontinuities in both the temperature dependence of T_1 and of the quadrupolar coupling constant e^2qQ. Using a plane wave approximation to describe the structural incommensuration, the appearance of, and the gradual downfield shift of the upfield shoulder can be satisfactorily fit to the data. From the temperature dependence of the quasicontinuous frequency distribution associated with the incommensurate structure, the upper transition temperature T/sub i/ is estimated to be 520 K.

20014 **Time-resolved emission spectroscopy of the high T/sub c/ superconductor YBa_2Cu_3O/sub 7-//sub x/ under laser ablation.** Yoo, K.M.; Alfano, R.R.; Guo, X.; Sarachik, M.P.; Isaacs, L.L. (Institute for Ultrafast Spectroscopy and Lasers, Department of Physics, The City College of New York, New York, New York 10031). *Applied Physics Letters;* **54**: No. 13, 1278-1279(27 Mar 1989).

Time-resolved luminescence spectroscopy is described for high T/sub c/ YBa_2Cu_3O/sub 7-//sub x/ under 8 ps/530 nm laser ablation. The emission spectrum covered most of the visible spectrum and showed emission lines from ions. The emission profiles in time consist of fast (≅25 ps) and slow (≅1 ns) decay components.

20015 **Crystal structure of $DyBa_2Cu_4O_8$: A new 77 K bulk superconductor.** Hazen, R.M.; Finger, L.W.; Morris, D.E. (Geophysical Laboratory, Carnegie Institution of Washington, 2801 Upton Street NW, Washington, DC 20008-3898). *Applied Physics Letters;* **54**: No. 11, 1057-1059(13 Mar 1989).

Single-crystal x-ray diffraction data from $DyBa_2Cu_4O_8$ are used to confirm the structure of $RBa_2Cu_4O_8$ (R = Y, Nd, Sm, Eu, Gd, Dy, Ho, Er, and Tm), all of which have been synthesized in bulk and display substantial Meissner diamagnetism. The structure is orthorhombic, space group Ammm, with a = 3.846 3(3), b = 3.872 6(3), and c = 27.237(2) A. Copper-oxygen layers parallel to (001) are dimpled as in the 1-2-3 structure. Unique copper-oxygen strips parallel to (100) have copper in distorted square-planar coordination. Magnitudes of oxygen anisotropic thermal vibrations are significantly less than in the 1-2-3 structure; thus the oxygen content of 1-2-4 is expected to be significantly more stable.

20016 **Epitaxial superconducting thin films of YBa_2Cu_3O/sub 7-//sub x/ on $KTaO_3$ single crystals.** Feenstra, R.; Boatner, L.A.; Budai, J.D.; Christen, D.K.; Galloway, M.D.; Poker, D.B. (Solid State Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831). *Applied Physics Letters;* **54**: No. 11, 1063-1065(13 Mar 1989).

We have grown thin YBa_2Cu_3O/sub 7-//sub x/ films on single-crystal (001)= $KTaO_3$ substrates by means of coevaporation of Y, BaF_2, and Cu, followed by an ex situ anneal in wet oxygen. The films are epitaxial in three dimensions, consisting of grains with either the c or the a axis of the YBa_2Cu_3O/sub 7-//sub x/ unit cell perpendicular to the substrate. Films with a composition close to the 1:2:3 cation ratio exhibit sharp superconducting transitions at 90 K and critical current densities in excess of 0.3 MA/cm^2 in zero magnetic field at 77 K. In Cu-rich films, the $Y_2Ba_4Cu_8O$/sub 16//sub —//sub x/ phase with a T/sub c/ of 80 K is formed in grains with the c axis perpendicular to the substrate.

20017 **Two-dimensional spin-1/2 antiferromagnetic Heisenberg model versus nonlinear σ model.** Manousakis, E.; Salvador, R. (Department of Physics, Center for Materials Research and Technology Supercomputer Computations Research Institute, Florida State University, Tallahassee, Florida 32306 and Control Data Corporation, Professional Services Division and Supercomputer Computations Research Institute, Florida State). *Physical Review Letters;* **62**: No. 11, 1310-1313(13 Mar 1989).

We study the continuum limit of the nonlinear σ model in 2+1 dimensions and at finite temperature T, using Monte Carlo simulation on large lattices. Even though the lattice spacing vanishes, dimensional transmutation occurs which makes the correlation lengths finite. With the assumption that the σ model and the spin-(1/2 antiferromagnetic Heisenberg model are equivalent at low T, we make contact between the two models and find that the latter model must order at T = 0. Our results are consistent with neutron-scattering experiments done on La_2CuO_4. .AE

20018 **Phase transformations in YBa_2Cu_3O/sub 7-//sub δ/.** Shi, D. (Materials Science Division, Building 223, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4299-4305(1 Mar 1989).

Isothermal annealing experiments have been carried out over a wide temperature range (200—700 °C) to study the mechanisms of the tetragonal-to-orthorhombic phase transformation. The annealed samples were analyzed by means of x-ray diffraction, electrical resistivity and magnetization measurements, and polarized light microscopy. The x-ray diffraction and magnetization results show that the tetragonal-to-orthorhombic phase transformation proceeds isothermally, indicating an oxygen diffusion-controlled process. Data from the polarized light microscopy show that a phase boundary exists between the tetragonal-to-orthorhombic phases, which moves gradually as a result of oxygen diffusion, from the sample surface towards the center, as annealing time is extended. Twinning occurs as oxygen is increased to just above 6.5, and twin boundaries are found to extend through all the grains even near the moving phase boundary. This twinning clearly indicates a martensite-related shear transformation. Transport properties, diffusion mechanisms, and the tetragonal-to-orthorhombic phase transformation process are discussed.

20019 **Vibrational analysis of tetragonal La/sub 2-//sub x/M/sub x/CuO_4 (M = Sr,Ba).** Maroni, V.A.; Brun, T.O.; Grimsditch, M.; Loong, C. (Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4127-4132(1 Mar 1989).

A simple valence-bond-type force field has been used to fit the observed Raman and infrared-active zone-center phonons of tetragonal La/sub 2-//sub x/M/sub x/CuO_4 (M = Sr, Ba). The phonon frequencies and assignments used in the fitting procedure were culled from a judicious comparison of existing literature data. An excellent fit to the four Raman-active k = 0 phonons and two (observed) of the seven (expected) infrared-active phonons was obtained using three adjustable parameters (one for each of the discrete near-neighbor bond types, Cu-O, La-O, and Cu-La) and a bond-scaling relationship which correlates the strength of a particular bond type, K/sub A//sub B//sup i/ with the length of the bond r/sub i/, i.e., K/sub A//sub B//sup i/ = C/sub AB//r/sub i/^{6}, where C/sub A//sub B/ is a constant. Optimization of the fitting parameters in this approximate force field produced an interestingly large Cu-La interaction, which is taken as evidence for a sizeable attractive force between each lanthanum atom and its nearest copper-oxygen plane. Also, the potential energy distribution indicates that the modes above 250 cm/sup -1/ are a mixture of Cu-O and La-O stretch, while those below 250 cm/sup -1/ contain large contributions from the Cu-La interactions.

20020 **C-axis stress dependence of normal and superconducting state properties of $YBa_2Cu_3O_7$.** Crommie, M.F.; Liu, A.Y.; Zettl, A.; Cohen, M.L.; Parilla, P.; Hundley, M.F.; Creager, W.N.; Hoen, S.; Sherwin, M.S. (Department of Physics, University of California at Berkeley, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4231-4234(1 Mar 1989).

We have applied pressure (i.e., stress) to single-crystal $YBa_2Cu_3O_7$ along the c axis to reduce the separation between the copper-oxygen planes. For the normal state, increasing pressures up to ~1 kbar causes the c-axis resistivity to decrease dramatically and tend toward a metalliclike temperature dependence. No change is observed in the ab-plane resistivity. The superconducting T/sub c/ increases with decreasing interplane separation with dT/sub c//dP≅0.1 K/kbar. Some implications of these findings for normal-state conduction mechanisms and models of high-T/sub c/ superconductivity for $YBa_2Cu_3O_7$ are discussed.

20021 Oxygen isotope effects in yttrium-barium-copper oxides. Ott, K.C.; Aikin, R.M.; Bernardez, L.; Connor, A.; Fluss, M.J.; Garcia, E.; Goldblatt, M.; Hutchinson, W.B.; Kwei, G.H.; Maggiore, C.J.; and others. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4285-4290(1 Mar 1989).

Superconducting yttrium-barium-copper oxide samples have been highly enriched with /sup 18/O (up to 91—96 at. %) by methods that ensure homogeneous distribution of the oxygen isotope throughout all lattice oxygen sites. The preparative routes used include the pyrolysis of nitrates, gas-phase exchange (which does not ensure homogeneous exchange of all sites), oxidation of amorphous YBa_2Cu_3 alloy, and hydrolysis oxidation of Y-BaF_2-Cu thin films. The T/sub c/'s of /sup 18/O-enriched samples vary with some methods of preparation. Some /sup 17/O-enriched samples were also prepared for comparison. The composition and structure of materials derived from the various preparative routes were characteized, and their magnetic and electrical properties were measured.

20022 Magnetic ordering in the high-temperature superconductor $ErBa_2Cu_3O$/sub 7-//sub δ/. Paul, D.M.; Mook, H.A.; Boatner, L.A.; Sales, B.C.; Ramey, J.O.; Cussen, L. (Department of Physics, University of Warwick, Conventry CV4 7AL, United Kingdom). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4291-4294(1 Mar 1989).

Neutron diffraction has been used to reexamine the magnetic ordering in the high-temperature superconductor, $ErBa_2Cu_3O$/sub 7-//sub δ/. A composite sample of five single crystals has been used for this investigation. The anomaly in the specific heat at 0.55 K is found to correspond to the formation of a three-dimensional, antiferromagnetic long-range-ordered state. This finding is in disagreement with an earlier measurement by Lynn et al., [Phys. Rev. B 36, 2374 (1987)] which suggested a two-dimensional magnetic structure.

20023 Neutron scattering study of soft optical phonons in La/sub 2-//sub x/Sr/sub x/CuO/sub 4-//sub y/. Thurston, T.R.; Birgeneau, R.J.; Gabbe, D.R.; Jenssen, H.P.; Kastner, M.A.; Picone, P.J.; Preyer, N.W.; Axe, J.D.; Boeni, P.; Shirane, G.; and others. (Center for Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4327-4333(1 Mar 1989).

The soft optical phonons associated with the tetragonal-to-orthorhombic structural phase transition in La/sub 2-//sub x/Sr/sub x/CuO/sub 4-//sub y/ have been investigated using inelastic-neutron-scattering techniques. Single crystals with Sr concentration of x = 0, 0.08, and 0.14 were studied. Both branches of the doubly degenerate X-point phonon which go soft at the tetragonal-to-orthorhombic transition have been observed in the orthorhombic phase. In all three samples one branch hardens, while the other remains relatively soft with behavior indicative of a further incipient structural phase transition. We identify the hard and soft branches of the orthorhombic phase as zone center and zone-boundary phonons, respectively. The zone-center mode has A/sub g/ symmetry and is, consequently, Raman active. The relation of these measurements to other structural properties and to the superconductivity in La/sub 2-//sub x/Sr/sub x/CuO/sub 4-//sub y/ is discussed.

20024 Metamagnetism in La_2CuO_4. Cheong, S.; Thompson, J.D.; Fisk, Z. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4395-4398(1 Mar 1989).

A careful study of the metamagnetic transition in single-crystalline La_2CuO_4 is presented. From magnetic susceptibility measurements the critical exponent (β) of the weak ferromagnetic state, which terminates at a triple point, has been estimated to be $\beta = 0.5 +- 0.02$, a value consistent with mean-field theory. Furthermore, the pressure dependence of the critical magnetic field for the transition has been examined from magnetoresistance measurements under hydrostatic pressure.

20025 Monte Carlo study of the quantum spin-(1/2 Heisenberg antiferromagnet on the square lattice. Gomez-Santos, G.; Joannopoulos, J.D.; Negele, J.W. (Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4435-4443(1 Mar 1989).

A new Monte Carlo sampling technique is used to study the spin-1/2 Heisenberg antiferromagnet on square lattices of up to 256 spins. The energy, specific heat, uniform and staggered susceptibilities, and correlation function are calculated. The correlation length as a function of temperature is deduced from correlation functions and is shown to be consistent with a quantum-renormalized classical approximation. Using the coupling constant provided by Raman scattering experiments, good agreement is found between the calculated and experimental correlation lengths in La_2CuO_4.

20026 Copper isotope effect in Raman scattering on superconducting YBa_2Cu_3O/sub 7-//sub x/. Mascarenhas, A.; Katayama-Yoshida, H.; Pankove, J.; Deb, S.K. (Solar Energy Research Institute, Golden, Colorado 80401). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4699-4700(1 Mar 1989).

Results of Raman scattering studies on the natural isotope superconductor YBa_2Cu_3O/sub 7-//sub x/ and the heavy isotope superconductor YBa_2/sup 65/Cu_3O/sub 7-//sub x/ are presented. The phonon at 148.6 cm/sup -1/ down-shifted by 1.8 cm/sup -1/ in YBa_2/sup 65/Cu_3O/sub 7-//sub x/ whereas the position of the phonon at 112.5 cm/sup -1/ remains unchanged. This conclusively relates the phonon mode at 148.6 cm/sup -1/ to the vibration of Cu(2) atoms and suggests that the phonon at 112.5 cm/sup -1/ is independent of Cu vibrations.

20027 Magnetic relaxation in sintered $Tl_2Ca_2Ba_2Cu_3O$/sub x/ and YBa_2Cu_3O/sub 7-//sub x/ superconductors. McHenry, M.E.; Maley, M.P.; Venturini, E.L.; Ginley, D.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4784-4787(1 Mar 1989).

We have characterized the time dependence of the zero-field-cooled magnetization for sintered pellets of the Tl 2:2:2:3 and Y 1:2:3 superconductors. The magnetic relaxation in both cases is large and exhibits a logarithmic time dependence. The temperature dependence of the relaxation rate A = dM/d ln(t) has been characterized for both materials for applied fields of 1,2,3, and 10 kG. The relaxation rate for the Y 1:2:3 sintered material is comparable to that observed in similar sintered materials and in single crystals. The Tl 2:2:2:3 material exhibits similar relaxation spectra with a weaker temperature dependence at a given field consistent with stronger pinning in this material. The temperature dependence of the relaxation is analyzed using a phenomenological relaxation model to yield an average pinning energy (0.33 eV at H = 1 kG) and its field dependence.

20028 Oxygen partial-density-of-states change in the YBa_2Cu_3O/sub x/ compounds for x≅6, 6.5, 7 measured by soft x-ray emission. Zhang, C.H.; Callcott, T.A.; Tsang, K.; Ederer, D.L.; Blendell, J.E.; Clark, C.W.; Scimeca, T.; Liu, Y. (University of Tennessee, Knoxville, Tennessee 37966). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4796-4799(1 Mar 1989).

We present oxygen K soft x-ray emission spectra for the YBa_2Cu_3O/sub x/ compounds with x nominally equal to 6, 6.5, and 7 and compare them with x-ray emission spectra determined from recent band-structure calculations. The K emission spectrum of O provides a measure of the p-type local partial density of states to (p-LPDOS) at the oxygen sites. As x decreases from 7-δ about 6.5, a chemical shift of the entire spectrum to lower energy indicates that screening is modified for all oxygen sites. The integrated intensity of the spectra is nearly unchanged by oxygen removal, indicating an increase in p-LPDOS per oxygen site. These results and changes in the spectral shape suggest that itinerant electron density near the O atoms is reduced and bound electron density is increased as oxygen is removed.

20029 **Polarized reflectivity studies of single-crystal La_2CuO_4.** Eklund, P.C.; Rao, A.M.; Lehman, G.W.; Doll, G.L.; Dresselhaus, M.S.; Picone, P.J.; Gabbe, D.R.; Jenssen, H.P.; Dresselhaus, G. (Department of Physics and Astronomy, University of Kentucky, Lexington, Kentucky 40506). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 389-395(Mar 1989).

Room-temperature polarized reflectivity measurements are reported for single-crystal La_2CuO_4 for the (E/sub perpendicular/ c-circumflex) and (E/sub parallel/ c-circumflex) polarizations, where c-circumflex denotes the tetragonal axis. A Kramers—Kroenig analysis is performed to obtain the frequency-dependent dielectric functions. Frequencies for the seven zone-center IR-active phonons are obtained and the longitudinal-optic—transverse-optic splittings are used to evaluate the dynamic charge on the oxygen atoms. The reflectivity spectrum for the (E/sub perpendicular/ c-circumflex) polarization is decidedly metallic and is fitted accordingly with an overdamped Drude model and a plasma frequency of 95 meV. In the high-frequency region of the spectrum, selection rules are observed for allowed and forbidden electronic transitions. The importance of this study to the interpretation of optical measurements on high-T/sub c/ polycrystalline pellets of La_2CuO_4 and related materials is also discussed.

20030 **Use of x-ray absorption spectroscopy in electronic structure studies of high-T/sub c/ superconducting oxides.** Soderholm, L.; Goodman, G.L. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 483-489(Mar 1989).

We use x-ray absorption near-edge structure (XANES) spectroscopy to investigate metal valence in high-temperature superconducting oxides. The experimental results presented here were obtained at the Cu K-absorption edge of La/sub 2-//sub x/Sr/sub x/CuO_4(x = 0, 0.15) and YBa_2Cu_3O/sub x/ (x = 6.3, 6.5, 6.9) and at the Bi L_3-absorption edge of Ba/sub 1-//sub x/K/sub x/BiO_3 (x = 0→0.5). We also have studied some standard oxides for comparison. In all three superconducting systems, transition temperatures are a function of x and reach a maximum for those values of x suggestive of nonintegral valences of the metal ions. Our results show that changes in the O content of YBa_2Cu_3O/sub x/ produce significant changes in the average charge environment of these Cu atoms, as reflected in K-edge XANES. In contrast, we find no significant changes in the charge environment of Cu in La/sub 2-//sub x/Sr/sub x/CuO_4 or of Bi in Ba/sub 1-//sub x/K/sub x/BiO_3, as indicated by our XANES results for various values of x. We discuss the question of the metal-ion valence and its relation to superconductivity.

20031 **Spectroscopy of the layered high-temperature superconductors and their collective plasmon modes: a model for phonon- and plasmon-induced pairing.** Kresin, V.Z.; Morawitz, H. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 490-495(Mar 1989).

The recently discovered layered copper oxide high-T/sub c/ superconductors are discussed as models of a layered electron gas with highly anisotropic collective modes (layer plasmons). Our view that a combined phonon—plasmon pairing interaction is the mechanism for the high transition temperatures is presented together with the appropriate dielectric function describing the electron collective response. The implications of this model for the interpretation of optical (infrared and optical absorption, reflectivity, and Raman scattering) and related spectroscopies, such as electron and positron loss, are given. In particular, temperature-dependent loss features are shown to arise from the lowest branch of the layer plasmons.

20032 **Magnetic susceptibility scaling in La/sub 2-//sub x/Sr/sub x/CuO/sub 4-//sub y/.** Johnston, D.C. (Ames Laboratory—U.S. DOE and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review Letters;* **62**: No. 8, 957-960(20 Feb 1989).

The powder magnetic susceptibility chi(T) of La/sub 2-//sub x/Sr/sub x/CuO/sub 4-//sub y/ is found to scale with doped hole concentration p = x-2y according to a law of corresponding states for 0≦p≦0.20, thereby allowing chi/sup Pauli/(p) of the holes and chi/sup 2D/(p,T) of the Cu/sup +2/ spin sublattice to be separated and precisely evaluated. chi/sup Pauli/ increases with p. The shape of chi/sup 2D/(T) is that of the spin-(1/2 square-lattice Heisenberg antiferromagnet; however, by p = 0.20, the in-plane Cu-Cu superexchange coupling constant and effective magnetic moment per Cu ion are both largely suppressed.

20033 **Near-tip mechanics of stress-induced microcracking in brittle materials.** Charalambides, P.G.; McMeeking, R.M. (Dept. of Materials and Dept. of Mechanical Engineering, Univ. of California, Santa Barbara, CA (US)). *Journal of the American Ceramic Society;* **71**: No. 6, 465-471(Jun 1988).

A continuum-mechanics description of stress-induced microcracking was developed. Modulus-reduction effects due to microcracking are taken into account through the model of Budiansky and O'Connell. This is used in conjunction with a modified microcracking criterion that stems from the work of Evans and Fu. The resulting constitutive law for a microcracking material was used in finite-element calculations to study the near-tip stress and strain fields and the size and shape of a small-scale damaged zone for a stationary mode I crack in an elastic body. The finite-element results for the stationary crack are used to predict asymptotic toughening values which correspond to a fully developed wake of microcracked material for a propagating crack. Substantial toughening can result. In contrast, the microcracking zone for a stationary crack is thought to make little or no contribution to material toughening. The theoretical results are discussed in the context of experimental observations for zirconia-toughened alumina.

20034 **Some considerations of nonideal transformation-zone profile.** Hsueh, C.H.; Becher, P.F. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Journal of the American Ceramic Society;* **71**: No. 6, 494-496(Jun 1988).

The nonideal transformation-zone profile, in which the volume fraction of transformed particles decreases with the increase in the lateral distance from crack surfaces, is considered for the stress-induced phase transformation in ceramics containing zirconia. It is shown that one source of this nonideal transformation-zone profile can be the size distribution of the transforming particles/grains. Then, an equation for toughening due to the existence of such a nonideal transformation-zone profile is derived. In calculating the toughness, it is shown that the uncertainty in determining the transformation-zone size, which can occur by attempts to fit it to an ideal zone profile, can be avoided by using the present approach.

20035 **Effects of fast neutron irradiation on thermal conductivity of Li/sub 2/O and LiAlO/sub 2/.** Ethridge, J.L.; Baker, D.E.; Miller, A.D. (Westinghouse Hanford Co., Richland, WA (US)). *Journal of the American Ceramic Society;* **71**: No. 6, C-294-C-296(Jun 1988).

Li/sub 2/O and LiAlO/sub 2/ are two candidates for solid breeder materials in the United States' Fusion Power Program. Critical to breeder design efforts are thermo-physical data, the bulk of which have only recently become available, for unirradiated lithium ceramics. This paper expands the current limited data base by presenting thermal conductivity data between 373 and 1173 K for both materials following fast neutron irradiation. Samples were irradiated at 773 to 1173 K to lithium burnups ≦ 11.5 x 10/sup 20/ captures/cm/sup 3/. Comparisons are made between these data and those from unirradiated archive samples of these same materials.

20036 **Tracer diffusion in pure and boron-doped Ni/sub 3/Al.** Hoshino, K.; Rothman, S.J.; Averback, R.S. (Mitsui Mining and Smelting, Central Research Lab., Saitama (JP)). *Acta Metallurgica;* **36**: No. 5, 1271-1279(May 1988).

Diffusion of /sup 63/Ni has been measured in pure and boron-doped polycrystalline Ni/sub 3/Al intermetallic compounds as a function of temperature (692-1352°C), Al concentration (24-26 at.%Al), and boron content (0-500 wt ppm). Volume and grain-boundary diffusion of /sup 60/Co and /sup 68/Ge have also been

measured in pure Ni/sub 3/Al. Both conventional grinding and ion beam sputtering techniques have been used for the determination of the concentration profiles. The diffusivity of Ni,D*/sub Ni/ is independent of Al content above 1000°C, indicating that antisite defects are prevailing on both sides of stoichiometry. However, D*/sub Ni/ shows a minimum at the stoichiometric composition below 1000°C, and this trend becomes clearer with decreasing temperature. The diffusivities of /sup 60/Co and /sup 68/Ge are also independent of Al concentration in the temperature range between 880 and 1200°C, but their grain-boundary diffusion depends on Al concentration. The addition of boron linearly increases D*/sub Ni/ above 1000°C, but at lower temperatures, D*/sub Ni/ in off-stoichiometric compositions decreases to the value for stoichiometric Ni/sub 3/Al on the addition of 100 wt ppm boron, and then increases as above with the further additions of boron to — 500 wt ppm. The present diffusion data suggest that a small concentration of vacancies, independent of temperature, is present on both sides of, and at, stoichiometry at low temperature.

20037 **Modification of YBa/sub 2/Cu/sub 3/O/sub 7-x/ ceramics by adsorbed water and other gases.** Ruckman, M.W.; Chen, D.H.; Moodenbaugh, A.R.; Heald, S.M.; Qui, S.L.; Lin, C.L.; Strongin, M.; Nichols, D.; Crow, J.E. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY (US); Dept. of Physics, Brookhaven National Lab., Upton, NY (US); Dept. of Physics, Temple Univ., Philadephia, PA (US)). pp v of Processing and applications of high Tc superconductors. Mayo, W.E. Warrendale, PA; The Metallurgical Society Inc. (1988). (CONF-880519—).

From 4. northeast regional meeting on processing and applications of high {Tc} superconductors; New Brunswick, NJ, USA (9 May 1988).

Surface modification of vacuum scraped YBa/sub 2/Cu/sub 3/O/sub 7-x/ (x = 0,1) by H/sub 2/O, CO, CO/sub 2/ and O/sub 2/ was studied using photoemission and the modification of bulk YBa/sub 2/Cu/sub 3/O/sub 7/ and YBa/sub 2/Cu/sub 3/O/sub 6.25/ by liquid water was studied using x-ray absorption. Photoemission measurements show that H/sub 2/O reacts with the surface by dissociating to form a surface hydroxide. CO and CO/sub 2/ form surface compounds that may be carbonates. Molecular oxygen dissociates and readily enters the bulk after adsorption on oxygen deficient material. The x-ray diffraction and absorption studies show that H/sub 2/O readily reacts with oxygen deficient material and completely disrupts it. BaCO/sub 3/ and a CuO-like phase are detected. YBa/sub 2/Cu/sub 3/O/sub 7/ is more stable and was not disrupted. Modification of the Cu K-edge and EXAFs resemble those seen when the material reacts with H/sub 2/ and this suggests that hydrogen may be produced during the surface reaction with water and may react with the bulk material.

20038 **Superconductivity at high temperature.** Kresin, V.Z. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

A review of recent achievements in the field of high T/sub c/ superconductivity is presented. The new materials are characterized by unusual properties. First of all, they are low-dimensional systems. For example La/sub 1.8/Sr/sub 0.2/CuO/sub 4/ (T/sub c/ - 40K) has a layered structure. The high T/sub c/ material Y/sub 1/Ba/sub 2/Cu/sub 3/O/sub 4/ contains, in addition, a set of one-dimensional chains. The carrier concentration is relatively small. All these properties are important for understanding the mechanisms of high T/sub c/ superconductivity. The possible contributions of different mechanisms are discussed. In particular, the authors are going to discuss the action of two mechanisms: strong electron-phonon interaction and the exchange of two-dimensional plasmons. Electron-plasmon coupling constant increases with decreasing carrier concentration. The system superconductor-semiconductor-superconductor is very promising, from the point of view of building a three-terminal device. The properties of such systems made with high T/sub c/ superconductors are described. The field effect is getting larger for these materials. Properties of the Josephson junction semiconductor-superconductor-insulator-superconductor are described.

20039 **Measurements of processes in ruthenium oxide film electrodes with the quartz-crystal microbalance technique.** Buttry, D.; Gottesfeld, S. (Los Alamos National Lab., Los Alamos, NM (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

The authors describe the first application of the quartz-crystal microbalance (QCM) technique for monitoring electrochemical processes in oxide film electrodes. They have investigated a film of ruthenium oxide, applied by the thermal decomposition of ruthenium chloride onto one side of the quartz-crystal. The quartz-crystal was precoated with gold keyhole patterns on both sides for inducing the 5 MHz resonance, followed by a thin Ti layer to ensure good adherence of the ruthenium oxide. Ruthenium oxide films are being investigated at Los Alamos for potential use in electrochemical capacitors. The material exhibits large charge capacity per geometric area and fast charge-discharge rates. Different possible processes can be responsible for charge compensation in such oxide materials, including those associated with simple double-layer charging, with pseudocapacitance, and with ion insertion into the small grains of the high-surface-area oxide material. The dynamics of such processes are determined, for a given oxide film, by the nature of the electrolyte and the resulting mechanism of charge-compensation. The QCM technique provides interesting information on these processes, as well as on film hydration and film dissolution process. The authors' initial results are presented in this paper. The results demonstrate the QCM as a sensitive tool for following not only ionic insertion processes during potential modulation, but also processes of film swelling and film dissolution.

20040 **Sodium- and sulfur-activity measurements using glass-membrane reference electrodes/sensors.** Bloom, I.; Heiberger, J.J.; Rea, K.; Redey, L. (Chemical Technology Div., Argonne National Lab., Argonne, IL (US)). pp v of Chemical sensors. Volume 87-9. Turner, D.R. Pennington, NJ; The Electrochemical Society (1987). (CONF-8710234—).

From Symposium on chemical sensors; Honolulu, HI, USA (18 Oct 1987).

Development of miniature reference electrode systems and designs to measure either sodium or sodium polysulfide activity has continued. The reference electrodes use small (2-mm/sup 2/ active area), thin membranes of a highly Na/sup +/-ion-conductive glass. Stable, reproducible EMF measurements which reflect activity differences have been observed from (Mo)Na vertical bar Glass vertical bar Na/sub 2/S/sub 4/(Mo) and Na/sub 2/S/sub x/(Mo) vertical bar Glass vertical bar Na/sub 2/S/sub y/(Mo) (x = 3), 4 and 5) cells at elevated temperatures. The utility of the electrode design was demonstrated by performing coulometric titrations of polysulfide electrodes (ca. 2-mAh capacity to Na/sub 2/S/sub 3/) in the temperature range of 300 - 400°C. The colometric titrations clearly show a sharp transition from the two-phase region to a single phase at 71 mol % sulfur. The lowest demonstrated temperature of operation for the reference electrode is 123°C in NaCl/AlCl/sub 3/ melts.

20041 **The surface mechanical properties and wear behavior of ion implanted TiB.** McHargue, C.J.; Yust, C.S.; Angelini, P.; Sklad, P.S.; Lewis, M.B. (Oak Ridge Nat. Lab., TN (US)). pp v of Science of hard materials. Proceedings of the international conference. Carboly, G.E. Accord, MA; Adam Hilger Ltd. (1986). (CONF-8409117—).

From 2. international conference on the science of hard materials; Rhodes, Greece (23 Sep 1984).

Implantation of 1 x 10/sup 17/ N . cm/sup -2/ (1 MeV) into polycrystalline TiB/sub 2/ produced an altered microstructure to a depth of 750 nm. The implantation damage was in the form of coarse dislocation tangles near the surface and the damage structure at greater depths. The surface mechanical properties, as measured by Knoop micro-indentation hardness, indentation fracture tough-

ness and scratch-wear resistance, were increased by 50 to 110% by implantation. During pin-on-disk tests, entire grians were removed by the process of grain boundary cracking.

3606 Other Materials

REFER ALSO TO CITATION(S) 19348, 19348, 19370, 19374, 19502, 19502, 19662, 19813, 19870, 19922, 20128, 20164, 20168, 20192, 20194, 20226, 20535, 20927, 21336, 21534

20042 **(ACIESP—60-Vol.2) Effects of x-rays on isotactic polypropylene.** Kawano, Y.; Soares, S. (Academia de Ciencias do Estado de Sao Paulo, SP (Brazil)). 1988. 6p. (CONF-8808156—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705606/JAW.

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

In order to understand the structural change caused by radiation, isotactic PP films were irradiated with x radiation, and their structures by X-ray diffraction and infrared and ultraviolet spectroscopies were studied. (M.C.K.).

20043 **(AD-A—200752/4/XAB) Investigations into the infiltration kinetics and interfacial bond strength of Al/SiC composites. Annual report.** Fishman, S.; Edwards, G.R.; Olson, D.L. (Colorado School of Mines, Golden (USA). Center for Welding and Joining Research). Jul 1988. 49p. (CSM-MT-CWR—088-022). NTIS, PC A03/MF A01.

The work for this project is continuing in the following two areas: 1) isothermal infiltration into porous compact and tube bundles or capillaries, and 2) a fundamental study of bonding at the metal/ceramic interface. In a continuing effort to understand the fundamental nature of the aluminum/SiC interface, a technique for determining properties at the metal/ceramic interface was proposed. The model provides a method for predicting interfacial properties from the measured optical properties of the metal and ceramic surfaces.

20044 **(AEEW-M—2465) Modelling reinforced concrete structures in DYNA3D.** Broadhouse, B.J.; Neilson, A.J. (UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div.). Oct 1987. 16p. (CONF-8709417—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705942/JAW.

From DYNA3D user group conference; London, UK (24 Sep 1987).

A material model for reinforced concrete has been implemented in the transient structural dynamics code DYNA3D. This paper outlines the constitutive material model, and presents comparisons of DYNA3D calculations and experiments on impulsively loaded panels, covering the full range of panel damage states from light cracking through to panel collapse or perforation. The results are presented using the post-processor code TAURUS, which has also been modified to provide mesh diagrams with superimposed crack patterns from the DYNA3D predictions.

20045 **(AERE-R—13186) Defects in detector grade silicon.** Wittam, E.M.; Totterdell, D.H.J. (UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.). Jun 1988. 13p. H.M. Stationery Office, London, price Pound 8.00.

Crystallographic defects in silicon can be observed by optical microscopy after appropriate etching techniques have been used. Such defects can be present after crystal growth, or can be process induced. This report describes some of the defects observed in high purity float-zone silicon used for the fabrication of nuclear radiation detectors. The defects were observed using Nomarski interference contrast microscopy.

20046 **(ANL/PPRNT—89-146) Gallosilicate sodalite: Further syntheses and structural details.** Newsam, J.M.; Jorgensen, J.D. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008348/JAW.

The syntheses of gallosilicate sodalites from solutions/gels with a range of compositions and their characterization by tga, ^{29}Si nmr and powder X-ray diffraction are described. Conventional gel compositions generally provide good products albeit typically in low yields. In none of these gel/solution routes are anti-Loewenstein materials with Si:Ga$<$1.0 observed. Similar to the aluminosilicate system, CAN-framework zeolites can be produced by addition of appropriate anions to the gels/solutions. The structure of a basic gallosilicate sodalite with Si:Ga = 1.25, determined by full profile analyses of time-of-flight powder neutron diffraction data, is essentially similar to that of the analogous aluminosilicates. 24 refs., 3 figs., 5 tabs.

20047 **(ANL/PPRNT—89-177) Rings, intermediate-range order, and vibrational spectra of a-$GeSe_2$.** Vashishta, P.; Kalia, R.K.; Ebbsjoe, I. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008473/JAW.

Using an effective interparticle interaction, the properties of a- $GeSe_2$ are investigated by molecular dynamics (MD) method. Most of the features in the structure factor and phonon density-of-states agree with experiments. The MD configurations show a predominance of 5-, 6-, and 7-fold rings, and {approximately}8% edge-sharing tetrahedra. We find that the first diffraction peak arises from Ge correlations in 7- and 8-fold rings, and the anomalous increase in its height on cooling is due to frustration enhanced by the increased density. A distinct companion feature of the A_1 mode is observed in 5- and 7-fold rings. 24 refs., 4 figs.

20048 **(ANL/PPRNT—89-178) ^6Li as a probe for the study of the NMR [nuclear magnetic resonance] of lithium ions in dehydrated and partially dehydrated zeolite A.** Tokuhiro, Tadashi; Iton, L.E.; Mattingly, M. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008472/JAW.

The $_6Li$ isotope has been used in a multinuclear magnetic resonance (NMR) study of A-type zeolite ion-exchanged with lithium. NMR spectra and spin-lattice relaxation times have been measured for ^6Li, ^7Li, ^{23}Na, ^{27}Al, and ^{29}Si in dehydrated and partially dehydrated samples of the zeolite. By use of a sample containing eight $^6Li^+$ ions in the unit cell, it is shown that the Li^+ ions preferentially (and exclusively) occupy the eight six-ring sites in the fully dehydrated A zeolite, but that this preference is reversed as long as the zeolite is not completely dehydrated. Li^+ ions are found in both the eight-ring and six-ring sites in the presence of very small amounts of residual water. Evidence in the literature indicates that Li^+ ions occupy only the six-ring sites in A-type zeolite which is partially rehydrated after being fully dehydrated. The distinction between the $^6Li^+$ ions in the two types of sites was made on the basis of differences in their quadrupole coupling constants and relaxation times. In the fully dehydrated zeolite, the Li^+ ion in the six-ring site has a quadrupole coupling constant of 3.83 kHz in an electric field gradient of approximately axial symmetry. Determination of its magnitude is facilitated by the small quadrupole moment of the ^6Li isotope. 19 refs., 2 figs., 3 tabs.

20049 **(ANL/PPRNT—89-179) Magnetic properties and Fermi surface of antiferromagnetic $SmCu_6$.** Onuki, Y.; Umezawa, A.; Kwok, W.K.; Crabtree, G.W.; Nishihara, M.; Ina, K.; Yamazaki, T.; Omi, T.; Komatsubara, T.; Maezawa, K. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008471/JAW.

We report measurements of the magnetic susceptibility, specific heat, magnetoresistance, Hall effect, and Fermi surface in $SmCu^6$. The susceptibility follows the Van Vleck form for Sm^{3+} near room temperature and shows two antiferromagnetic phase transitions at 9.6 K and 5.2 K. The specific heat implies a quartet ground state for the crystal field split J = 5/2 angular momentum state. Magnetoresistance indicates two conduction carriers of uncompensated electrons and holes. de Haas-van Alphen measurements show that the Fermi surface in the antiferromagnetic state

consists of a network of cylinders oriented 30{degree} from the b and c axes. 14 refs., 10 figs.

20050 (ANL/PPRNT—89-181) Refractive index and density of Na-, Rb- and mixed Na, Rb-aluminogermanate glasses. Jin, G.L.; Liu, Y.; Mundy, J.N. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008363/JAW.

Refractive index and density measurements are given for the ternary systems X M_2O:Y Al_2O_3:(1-X-Y)GeO_2 where M = Na and Rb for Na/(Na + Rb) = 0, 0.3, 0.5, 0.7 and 1.0; (1-X-Y) = 0.7, 0.8 and 0.9 and Y/X = O, O.3 and 1.0. The values of the molar refractivity, R, are related to the structure of the glass. At low alkali concentrations, the decrease in R with increasing X is related to the closer packing of the network. At high alkali concentrations the changes in R appear to be controlled by the introduction of nonbridging oxygens into the network. Alumina additions to the germania network strongly increase R and this appears to be related to change in the network packing brought about by the conversion of Ge^{4+} from octahedral to tetrahedral coordination. 31 refs., 5 figs., 2 tabs.

20051 (BNL—42030) Electrically conductive polymer concrete overlay installed in Pulaski, Virginia. Fontana, J.J.; Reams, W.; Elling, D. (Brookhaven National Lab., Upton, NY (USA)). Feb 1988. Contract AC02-76CH00016. 32p. (CONF-880350—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007041/JAW.

From Technical symposium on polymers in concrete; Orlando, FL, USA (20 Mar 1988).

We report the development of a premixed electrically conductive polymer concrete overlay for use on bridge decks and other concrete members, in conjunction with cathodic protection systems. The development of a conductive overlay culminated in the installation of such an overlay on a full-bridge deck in Pulaski, Virginia; the active cathodic protection system has operated for eight months and is being monitored on a monthly basis. The monitoring shall continue for about 18 months. 11 refs., 18 figs., 1 tab.

20052 (CONF-861211—30) Small angle x-ray scattering behavior of microporous fibers used in composite structures. Effler, L.J.; Fellers, J.F.; Lin, J.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007840/JAW.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Small Angle X-ray Scattering (SAXS) is useful for documenting and interpreting defects that disrupt the structural integrity of carbon and Kevlar fibers. The main defect in these fibers is a set of elongated microvoids embedded in a highly developed and oriented crystalline phase. The microvoid phase of Kevlar49 fibers, polyacrylonitrile (PAN) and pitch based carbon fibers was probed using SAXS techniques, both before, and after, the fibers were subjected to a plasmas etching process. The response of the fiber to the etching process was found to be dependent on both material characteristic and fiber processing techniques. The average void size, and breadth of the distribution was monitored by assuming a Williams-Watts type correlation function. This new approximation method is discussed and compared with the more familiar Debye correlation function. This new approximation allows for quantitative assessment of the distribution of void sizes. 61 refs., 12 figs., 7 tabs.

20053 (CONF-881066—6) Characterization of radiation damage at the Nb site in natural pyrochlores and samarskites by x-ray absorption spectroscopy. Greegor, R.B.; Lytle, F.W.; Chakoumakos, B.C.; Lumpkin, G.R.; Warner, J.K.; Ewing, R.C. (Boeing Aerospace Co., Seattle, WA (USA); New Mexico Univ., Albuquerque (USA). Dept. of Geology). 1988. Contract FG06-84ER45121;FG04-84ER45099. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008143/JAW.

From 12. international symposium on the scientific basis for nuclear waste management; Berlin, F.R. Germany (10 Oct 1988).

X-ray absorption spectroscopy has been used to investigate the Nb B-site in pyrochlores (A/sub 1-2/B_2O_6Y/sub 0-1/, Fd3m, Z = 8) and samarskites ($A_3B_5O_{16}$) in both metamict and annealed condition. The XANES and EXAFS measurements indicate significant changes in pyrochlore and smaller changes in samarskite as a result of radiation damage. In the metamict state the Nb site in both pyrochlores and samarskites is similar to Nb in Nb_2O_5. Short Nb-O (1.65{angstrom}) bonds are not disrupted by alpha-decay/recoil-nuclei events as much as longer bonds (2.00{angstrom}). This increases the asymmetry and static disorder at the local Nb site while long range order is greatly diminished resulting in considerable distribution in Nb-M distances and bond angles. 23 refs., 5 figs., 1 tab.

20054 (CONF-8808149—6) Application of various XAFS techniques to the investigation of structurally damaged materials. Greegor, R.B.; Lytle, F.W.; Chakoumakos, B.C.; Ewing, R.C.; Livak, R.J.; Clinard, F.W. Jr.; Crozier, E.D.; Alberding, N.; Seary, A.J.; Arnold, G.W. (Boeing Aerospace Co., Seattle, WA (USA)). 1988. Contract FG06-84ER45121. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008142/JAW.

From 5. international conference on X-ray absorption fine structure; Seattle, WA, USA (21 Aug 1988).

We have applied several XAFS techniques to study materials which have been structurally modified in a variety of ways. These techniques include conventional absorption and fluorescence methods as well as electron yield at atmospheric pressure, grazing incidence and optical EXAFS. The method used depended upon the sample to be investigated and the information desired. The various samples examined and the approaches used are discussed for natural metamict minerals, Pu doped zirconolite, 50/200 keV Pb implanted $SrTiO_3$ and Mn containing glass. 2 refs., 1 fig.

20055 (CONF-8809123—2) Fatigue-resistant photochromic plastics. Chu, Nori Y.C. (American Optical Corp., Southbridge, MA (USA)). 1988. Contract AC03-87SF17300. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007336/JAW.

From International congress on optical science and engineering; Hamburg, F.R. Germany (22 Sep 1988).

The optical switching properties of a photochromic spirooxazine compound in retrofit polyester film and in poly(vinyl butyral) have been measured. The light fatigue resistance of these two optical switching elements were tested by an accelerated method. The length of photochromic activity of the optical switching elements can be improved by various organonickel and hindered amine light stabilizers. The effectiveness and optimal concentration for each light stabilizer in these host materials has been determined. These two types of light stabilizers act synergistically in improving the light fatigue resistance of the optical switching elements significantly. 14 refs., 2 figs., 3 tabs.

20056 (CONF-8810318—1) ESE [electron spin echo] and CW-ESR studies of synthetic diamond crystals: Distribution of nitrogen and nickel. Isoya, J.; Lin, C.P.; Bowman, M.K.; Norris, J.R.; Yazu, S.; Sato, S. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007373/JAW.

From 1. international conference on the new diamond science and technology; Tokyo, Japan (24 Oct 1988).

Both dispersed impurities and dispersed nickel impurities in synthetic type Ib diamond crystals give distinctive ESR spectra. We demonstrate that inhomogeneities in the distribution of the nitrogen and the nickel impurities can be characterized by instantaneous spectral diffusion measurements in two-pulse electron spin echo measurements. In a series of thirteen synthetic crystals, most (>90%) of the nitrogen centers are in regions with high local concentration. The remainder is present in regions of lower concentration. 10 refs., 2 figs.

20057 **(DOE/ER/45150—T2) Analytical electron microscopy studies of interfaces and phase transformations in zirconia ceramic systems: Progress report, July 1, 1988--June 30, 1989.** Notis, M.R. (Lehigh Univ., Bethlehem, PA (USA)). 1989. Contract FG02-84ER45150. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008269/JAW.

The goal of this research is to gain an understanding of the nature of interphase interfaces, phase-equilibria and phase transformations in ceramic systems which have high potential for property improvement through transformation toughening. We have focused our attention on studies concerning: (1) The nature of interphase interfaces in zirconia based eutectics (because of the well defined orientation relationships present at eutectic interfaces). The first model system which we have extensively studied is the NiO-ZrO_2 (CaO) (NZ) DSE system. (2) The effects of ternary additions on the growth kinetics of precipitates in magnesia partially stabilized zirconia (Mg PSZ) ceramics.

20058 **(DOE/ER/45216—2) Electronic and structural properties of semiconductor heterojunctions: Final report, July 1, 1986--December 31, 1988.** Chung, Y.W. (Northwestern Univ., Chicago, IL (USA)). Mar 1989. Contract FG02-85ER45216. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008750/JAW.

The system we examined in this investigation is the Sn/CdTe system. We and others found several years ago that it is possible to stabilize the diamond cubic form of Sn by depositing it onto clean ordered surfaces of CdTe under ultrahigh vacuum conditions. In addition, we found that when the thickness of the Sn films is sufficiently small, a small bandgap opens up (the bulk bandgap of Sn is zero) with magnitude depending on the film thickness. The objective of our investigation is to study the electronic and structural properties of such system. The films were all grown by standard MBE techniques. The resulting samples were examined by Auger, photoelectron spectroscopy, SEM and scanning tunneling microscopy. Summary findings are described in the next section.

20059 **(DOE/SF/17300—T1) Innovative concepts for the solar building program evaluation of photochromic plastics: Final report, October 1987--September 1988.** Chu, Nori Y.C. (American Optical Corp., Southbridge, MA (USA)). Oct 1988. Contract AC03-87SF17300. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006701/JAW.

The objective of this program is to investigate the feasibility of using photochromic plastics as optical switching glazing apertures for control and/or use of solar energy employing a new class of light durable photochromic compounds, spirooxazines. Phase I involved formulating and evaluating different polymer compositions with various light absorbers and light stabilizers to improve the photochromic durability of spirooxazines in several polymeric hosts. A significant portion of our efforts has been concentrated on obtaining a formation which is usable for the commercial glue-on polyester films to impart them with an added optical switching property. Two types of light stabilizers, organonickel and hindered amine light stabilizers, can significantly improve the photochromic durability of spirooxazines without impairing their photochromic functions. The most effective light stabilizers for each polymeric host have been identified and used to formulate plastic compositions for the preparation of durable optical switching elements. We have formulated two acrylic adhesives containing both organonickel and hindered amine light stabilizers which are very photostable. 4 refs., 5 figs., 5 tabs.

20060 **(DP-MS—88-184) Evaluation of sorbent materials.** Rankin, W.N.; Gomillion, S.L.; Luckenbach, R.L. (Savannah River Lab., Aiken, SC (USA)). 1989. Contract AC09-76SR00001. 11p. (CONF-890207—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006429/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

The sorption efficiency of different types of liquid sorbent materials was determined under carefully controlled laboratory conditions. Results show that the sorption capacity is affected both by the type of material and by the form of the material. Attractive alternate sorbents to "atomic wipes" and Oil-Dry were identified. Small pillows of shredded synthetic sorbents are an attractive alternative to Oil-Dry as a sorbent and to "atomic wipes" as both a sorbent and in decontamination by wiping. Synthetic sorbents in cloth form offer an attractive alternative to "atomic wipes" in decontamination by wiping because these materials are compatible with nitric acid and they may be more fire resistant. A larger-scale evaluation is planned with the most promising sorbents. In addition, development is planned of a sorbent that will be efficient, compatible with nitric acid and fire resistant. 6 refs., 2 tabs.

20061 **(JAERI-M—88-195) Compilation of structural property data for computer impact calculation (5/5). Wood.** Ikushima, Takeshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 54p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756912/JAW.

The paper describes structural property data for computer impact calculations of nuclear fuel shipping casks. Four kinds of material data, mild steel, stainless steel, lead and wood are compiled. These materials are main structural elements of shipping casks. Structural data such as, the coefficient of thermal expansion, the modulus of longitudinal elasticity, the modulus of transverse elasticity, the Poisson's ratio and stress and strain relationships, have been tabulated against temperature or strain rate. This volume 5 involve structural property data of wood.

20062 **(JAERI-M—88-197) Comparison of gamma-ray and electron beam induced degradation of polymer insulating materials.** Haruyama, Yasuyuki; Morita, Yohsuke; Seguchi, Tadao; Tanaka, Ryuichi; Kanazawa, Takao; Yotsumoto, Keiichi; Yoshida, Kenzo. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 37p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756914/JAW.

In the radiation environments of nuclear reactors and high power particle accelerators, large amounts of organic polymer materials are used as electric insulator, lubricant, sealant, etc. The mechanical and electrical properties of these materials are gradually degraded by the exposure of mixed radiation of gamma-rays, X-rays, electrons and neutrons. For the precise evaluation of radiation resistance, it is necessary to understand the degradation behavior of polymer materials by various kinds of radiations. For the comparison of gamma-rays and electron beam induced degradation, seven polymer materials, polyethylene (PE), polypropylene (PP), silicone rubber (SiR), natural rubber (NR), fluorine rubber (FR), ethylene-vinylacetate copolymer (EVA) and isobutylene-isoprene rubber (IIR) were irradiated with Co-60 gamma-rays and 2 MeV electron beam under vacuum at room temperature. Exposure rate of gamma-rays and absorbed dose of electron beam were measured by use of an ionization chamber and CTA film dosimeter, respectively. Degradation of irradiated materials was estimated by the measurement of gas evolution, gel fraction and swelling ratio, and tensile properties. Six polymers except EVA showed almost the same degradation behavior for gamma-rays and electron beam through the gel fraction and swelling ratio measurements and the tensile tests, whereas gas evolution was slightly accelerated by gamma-ray irradiation. EVA showed a different degradation behavior for gamma-rays and electron beams; larger decreases of the tensile properties were observed for the samples irradiated with gamma-rays.

20063 **(Juel-Conf—63) Contributions for the international conference on carbon and graphite CARBON '88.** Delle, W. (comp.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Aug 1988. 28p. (CONF-880949—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756960/JAW.

From CARBON '88; Newcastle upon Tyne, UK (18 Sep 1988).

This report is the compilation of three papers prepared by the Kernforschungsanlage Juelich GmbH (KFA) in collaboration with other partners for the International Conference CARBON '88.

The topics were as follows: (1.) Fracture toughness of fast neutron irradiated graphite (W. Delle, H. Derz, G. Kleist, H. Nickel, W. Thiele); (2.) The irradiation creep characteristics of graphite to high fluences (C.R. Kennedy, M. Cundy, G. Kleist); and (3.) New silicon carbide materials starting with the Coat-Mix procedure (H.K. Luhleich, K. Bach, F.J. Dias, M. Kampel, F. Koch, H. Nickel).

20064 **(LA—11426-T) Dynamic properties of reinforced concrete shear wall structures.** Farrar, C.R. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 169p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007670/JAW.

The purpose of this work was to determine the structural properties (stiffness and damping) of low aspect ratio shear wall structures that can be used in lumped mass models to predict their dynamic response. Instrumentation was used to separate the deformation of the structures into components caused by shear and components caused by bending so that individual components of stiffness can be examined. Results from these experiments showed that the current industry standard of using a stiffness based on an uncracked cross-section, strength-of-materials analysis, neglecting the reinforcement, and including shear deformation is appropriate prior to cracking. After cracking, the stiffness was shown to be a function of load level, past load history, and the amount of reinforcement. 96 refs., 53 figs., 12 tabs.

20065 **(LA—11512-MS) SESAME equation of state for a polymer composite: Phenolic refrasil.** Boettger, J.C. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 12p. NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89008408/JAW.

An equation of state (EOS) for phenolic refrasil has been constructed for the SESAME library as material number 7580. It is shown that the principal Hugoniot for this polymer composite cannot be described by simply mixing separate EOS for the two constitutents (phenolic and fiber glass). This result has serious implications for future work on composites and for the range of applicability of EOS number 7580. In the process of this work, an EOS for phenolic has also been constructed as material number 7570. 12 refs., 3 figs.

20066 **(LBL—26018) Molecular thermodynamics of polymer melts at interfaces.** Theodorou, D.N. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 109p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008853/JAW.

A lattice model is developed for the prediction of structure and thermodynamic properties at free polymer melt surfaces and polymer melt/solid interfaces. Density variations in the interfacial region are taken into account by introducing voids in the lattice, in the spirit of the equation of state theory of Sanchez and Lacombe. Intramolecular energy (chain stiffness) effects are explicitly incorporated. The model is derived through a rigorous statistical mechanical and thermodynamic analysis, which is based on the concept of availability. Two cases are considered: "full equilibrium," whereby the interfacial polymer is taken as free to exchange heat, work and mass with a bulk polymer phase at given temperature and pressure; and "restricted equilibrium," whereby a thin polymer film is allowed to equilibrate locally in response to ambient temperature and pressure, but in which chains do not necessarily have the same chemical potential as in the unconstrained bulk. Techniques are developed for calculating surface tension, adhesion tension, density profiles, chain shape, bond orientation, as well as the distribution of segments of various orders in the interfacial region. 28 refs., 6 figs.

20067 **(N—89-14100) Growth of large zeolite crystals in space.** Sacco, A. Jr.; Dixon, A.; Thompson, R.; Scott, G.; Ditr, J. (Worcester Polytechnic Inst., MA (USA)). 1988. 5p. (NASA-CR—183262; NAS—1.26:183262). NTIS, PC A02/MF A01.

Synthesis studies performed using close analogs of triethanolamine (TEA) have shown that all three hydroxyl groups and the amine group in this molecule are necessary to provide nucleation suppression. Studies using C-13 nuclear magnetic resonance (NMR) revealed that the hydroxyl ions and the amine group are involved in the formation of an aluminum complex. It was also shown that silicate species do not interact this way with TEA in an alkaline solution. These results suggest that successful aluminum complexation leads to nucleation in zeolite-A crystallization.

20068 **(N—89-14306) Statistical characterization of carbon phenolic prepreg materials, volume 1. Final report.** Beckley, D.A.; Stites, J. Jr. (Hitco, Gardena, CA (USA)). Apr 1988. 209p. (NASA-CR—179416; NAS—1.26:179416). NTIS, PC A10/MF A01.

The objective was to characterize several lots of materials used for carbon/carbon and carbon/phenol product manufacture. Volume one is organized into testing categories based on raw material of product form. Each category contains a discussion of the sampling plan, comments and observations on each test method utilized, and a summary of the results obtained each category.

20069 **(N—89-14331) Atomic oxygen effects measurements for shuttle missions STS-8 and 41-G.** Visentine, J.T. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). Sep 1988. 94p. (NASA-TM—100459-VOL-1; NAS—1.15:100459-VOL-1). NTIS, PC A05/MF A01.

The effects of atomic oxygen exposure upon typical spacecraft materials, such as polyimide films, thermal control paints, epoxies, silicones, and fluorocarbons are summarized.

20070 **(N—89-14338) Some composite bearing and seal materials for gas turbine applications: A review.** Sliney, H.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1989. 15p. (NASA-TM—101451; E—4561; NAS—1.15:101451; CONF-890612—). NTIS, PC A03/MF A01.

From 34. international gas turbine and aeroengine congress and exposition; Toronto, Canada (4 Jun 1989).

A review is made of the selection and tribological testing of materials for high-temperature bearings and seals. The goal is to achieve good tribological properties over a wide range of temperatures because bearings and seals must be functional from low temperature start-up conditions on up to the maximum temperatures encountered during engine operation. Plasma sprayed composite coatings with favorable tribological properties from 25 to 900 C are discussed. The performance of these coatings in simple tribological bench tests is described. Examples are also given of their performance in high-speed sliding contact seals and as Stirling cylinder liner materials, and as back up lubricants for compliant foil gas bearings.

20071 **(N—89-14868) Crystal growth of CdTe in space and thermal field effects on mass flux and morphology.** Wiedemeier, H. (Rensselaer Polytechnic Inst., Troy, NY (USA)). 1988. 11p. (NASA-CR—183263; NAS—1.26:183263). NTIS, PC A03/MF A01.

The primary, long-range goals are the development of vapor phase crystal growth experiments, and the growth of technologically useful crystals in space. The necessary ground-based studies include measurements of the effects of temperature variations on the mass flux and crystal morphology in vapor-solid growth processes. For in-situ mass flux measurements dynamic microbalance techniques will be employed. Crystal growth procedures and equipment will be developed to be compatible with microgravity conditions and flight requirements. Emphasis was placed on the further development of crystal growth and the investigation of relevant transport properties of CdTe. The dependence of the mass flux on source temperature was experimentally established. The CdTe synthesis and pretreatment procedures are being developed that yield considerable improvements in mass transport rates, and mass fluxes which are independent of the amount of source material. A higher degree of stoichiometric control of CdTe than before was achieved during this period of investigation. Based on this, a CdTe crystal growth experiment, employing physical vapor transport, yielded very promising results. Optical microscopy and X-ray diffraction studies revealed that the boule contained several large sized crystal grains of a high degree of crystallinity. Further characterization studies of CdTe crystals are in progress. The reaction chamber, furnace dimensions, and ampoule location of the dynamic microba-

lance system were modified in order to minimize radiation effects on the balance performance.

20072 **(N—89-14871) Application of linear response theory to experimental data of simultaneous radiation and annealing response of a CMOS device. Quarterly report No. 3, 8 June-8 September 1988.** Litovchenko, V. (Catholic Univ. of America, Washington, DC). 1988. 6p. (NASA-CR—183401; NAS—1.26:183401). NTIS, PC A02/MF A01.

Results from the application of linear response theory are compared to experimental data from simultaneous radiation and annealing response of a CMOS device. In particular, a method is applied which was developed earlier to determine the characteristic time, t(0), as well as the parameters A and C in the ln(t) dependence of the linear response function R(t) = -C + A1n(1-t/t(0)). The method is based on a study of the linear response for t being much less than t(0), when R(t) can be expanded in a power series of t: R(t) = R(0) + R'(0)t + 1/2R''(0)t-squared + 1/3R'''(0)t-cubed + ..., where R'(0) and R''(0) are, respectively, the first and second derivatives of R with respect to t. To find the linear response, R(t-t') is substituted in the form of this power series equation into a general equation for the shift of the threshold potential. To test the method, irradiation experiments were conducted on RCA 10(6) rad-hard CMOS IC's. A dose rate of approximately 130 rads/min was used. An IC was irradiated with Co-60 gamma rays for several hours, taking measurements of the threshold potential for one n-channel and one p-channel transistor every ten minutes. For the p-channel transistor, t(0) was found to be approximately 110 min and for the n-channel, t(0) was approximately 70 min. For the p-channel, the theoretical curve deviates from the experimental points only after 70 min; for the n-channel, the deviation takes place after 45 min. Additional findings are discussed and the application of the method to pure annealing is described.

20073 **(ORNL/M—703) Shielding effectiveness of indium-tin-oxide composite materials.** Googe, J.M.; Hess, R.A.; Moore, M.R. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007929/JAW.

Two sample holders for metal-filled plastic samples, the American Society for Testing Materials (ASTM) holder and the National Institute of Standards and Technology (formerly the National Bureau of Standards, or NBS) holder, have been proposed as standards for shielding effectiveness testing. The NBS device is the result of a redesign of the ASTM coaxial TEM cell to eliminate the errors caused by contact resistance between the fixture and test sample. Published data obtained with the ASTM fixture have not been in agreement with theoretical predictions, nor have they been repeatable. The NBS design has eliminated these problems. A modification kit has been designed to convert the Elgal Test Set 19A, a version of the ASTM holder, to the equivalent of the NBS holder. Tests on metal-loaded plastic samples indicate that the NBS design produces data that are repeatable and in good agreement with analytical predictions based on the bulk conductivity of the samples. Indium-tin-oxide composite materials obtained from a US Navy development program were tested using an automated SE test system and found to be very poor electromagnetic shields. 8 refs., 12 figs.

20074 **(PB—89-135750/XAB) Study of the condensation reaction of an epoxy-amine system using nuclear magnetic resonance: synthesis of epoxy-amine models.** Francillette, J.; Madec, P.J.; Hoarau, P.A. (Etablissement Technique Central de l'Armement (ETCA), 94 - Arcueil (France). Centre Mecanique Chimie Materiaux). 17 Jun 1987. 22p. (In French). (ECTA—87-R-055). NTIS, PC E03/MF E03.

This report is on part of a study of the aging of plastics and composites having a thermosetting matrix of an epoxide nature. It deals with the characterization (using nuclear magnetic resonance spectroscopy) of epoxy-amine condensates (mono- and polycondensate structures) as a function of starting reactant stoichiometry and stock temperature.

20075 **(PB—89-135834/XAB) Aging of polymer and composite materials-epoxy/amines cross links: relationships between structures and properties.** Bergel, A.; Wallez, N.; Hoarau, P.A. (Etablissement Technique Central de l'Armement (ETCA), 94 - Arcueil (France). Centre Mecanique Chimie Materiaux). 30 Dec 1987. 54p. (In French). (ECTA—87-R-152). NTIS, PC E04/MF E04.

The report describes research on the relationship between structure and properties in epoxy, duroplastic, polymer materials. The studies were concerned with defining structure as a function of the cross-linkage rate using an Arrhenius approach. The studies based on the use of infrared absorption spectra showed that activation energy is independent of the cross-linkage rate and that hydrogen bonds contribute not only to the process of polymerization but also to the mechanical behavior of these materials.

20076 **(PB—89-855548/XAB) Mercury cadmium tellurides (HgCdTe): fabrication, properties, and applications. January 1971-February 1989 (Citations from the NTIS data base). Report for January 1971-February 1989.** (National Technical Information Service, Springfield, VA (USA)). Feb 1989. 168p. NTIS PC N01/MF N01.

Supersedes PB—88-857784.

This bibliography contains citations concerning fabrication methods, electrical and optical properties, and applications for mercury cadmium tellurides (HgCdTe). Topics include liquid-phase and molecular-beam epitaxial growth of HgCdTe, optical and electrical characterizations of various epitaxial HgCdTe films and layers, HgCdTe surface studies, directed-energy techniques, and effects of electromagnetic radiation on the physical properties of HgCdTe. Applications of HgCdTe materials for the development of photodiode modules and infrared, photoconductive, and photovoltaic detectors are presented. (This updated bibliography contains 279 citations, 92 of which are new entries to the previous edition.)

20077 **(UCID—21242) Chrome doped gallium arsenide evaluation.** Pocha, M.D.; Morse, J.D.; Brazes, W.F. (Lawrence Livermore National Lab., CA (USA)). 10 Oct 1987. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008640/JAW.

We received, for free, two sets of Chrome doped Gallium Arsenide (GaAs:Cr) wafers, one from Cominco Electronic Materials, Inc., and the other from Furakawa Electric Co., for the purpose of evaluation as potential material for high speed photoconductive detectors. In return for the free material we promised to give the two manufacturers feed back on our evaluation of these wafers. The primary purpose of this report is to present the results of our evaluation of these wafers and conclusions regarding the usefulness of heavily doped GaAs:Cr for photoconductive detectors. We have found that response times of less than 100 ps (FWHM) are possible with GaAs:Cr detectors, but that there are several time constants to the decay which result in very long "tails" to the impulse response of these detectors. These long tails are unacceptable for most detector applications, but there may be some special cases where GaAs:Cr could be used. 5 figs., 1 tab.

20078 **Cooling rate dependence of cation distributions in $CoFe_2O_4$.** De Guire, M.R.; O'Handley, R.C.; Kalonji, G. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Journal of Applied Physics;* **65**: No. 8, 3167-3172(15 Apr 1989).

The room-temperature cation distributions in bulk $CoFe_2O_4$ samples, cooled at rates between $<10^{-2}$ and $\sim 10^{3}$ °C s^{-1}, have been determined using Moessbauer spectroscopy in an 80-kOe magnetic field. With increasing cooling rate, the quenched structure departs increasingly from the mostly ordered cation distribution ordinarily observed at room temperature. However, the cation disorder appears to saturate just short of a random distribution at very high cooling rates. These results are interpreted in terms of a simple relaxation model of cation redistribution kinetics. The disordered cation distributions should lead to increased magnetization and decreased coercivity in $CoFe_2O_4$.

20079 Lattice vibration spectra of GaP/sub 1-//sub x/ Sb/sub x/ and InP/sub 1-//sub x/Sb/sub x/. Cherng, Y.T.; Jaw, D.H.; Jou, M.J.; Stringfellow, G.B. (Department of Materials Science and Engineering, University of Utah, Salt Lake City, Utah 84112). *Journal of Applied Physics;* **65**: No. 8, 3285-3288(15 Apr 1989).

Raman scattering spectra of ternary semiconductor alloys GaP/sub 1-//sub x/Sb/sub x/ and InP/sub 1-//sub x/Sb/sub x/ have been investigated in the spectral region from 150 to 450 cm^{-1} at room temperature. The optical phonons of both GaP/sub 1-// sub x/Sb/sub x/ and InP/sub 1-//sub x/Sb/sub x/ exhibit "two-mode" behavior over the whole composition range. A random element isodisplacement model is used to describe the behavior of the optical phonons of both alloy systems. The calculations of the dependence of the long-wavelength optical phonon frequencies on the composition are in good agreement with the experimental results.

20080 Systematic analysis of the spectra of the lanthanides doped into single crystal LaF_3 . Carnall, W.T.; Goodman, G.L.; Rajnak, K.; Rana, R.S. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **90**: No. 7, 3443-3457(1 Apr 1989).

The optical spectra of the lanthanides doped into single crystal LaF_3 have been interpreted in terms of transitions within 4f /sup N/ configurations. Energy matrices combining free-ion terms with a crystal field for an approximate model which assumes C_2/sub v/ instead of the actual C_2 site symmetry were diagonalized. Excellent correlations were obtained between experimental transition energies and the computed level structures. We also report the results of previously unpublished experimental spectroscopic investigations of Nd^{3+} and Sm^{3+}:LaF_3, as well as predicted energy levels for Pm^{3+}:LaF_3. The spectroscopic data for each ion were independently interpreted using an effective-operator model, then the model parameters were intercompared. Systematic trends have been identified, and a comprehensive energy level diagram is presented.

20081 Mobility-lifetime products in $CuGaSe_2$. Balberg, I.; Albin, D.; Noufi, R. (The Racah Institute of Physics, The Hebrew University, Jerusalem 91904, Israel). *Applied Physics Letters;* **54**: No. 13, 1244-1246(27 Mar 1989).

We report the first accurate determination of mobility-lifetime products, $\mu\tau$au, in thin films of a Cu-ternary chalcopyrite by photoconductivity and ambipolar diffusion length measurements. We found that for Cu-deficient, nearly intrinsic $CuGaSe_2$ at an illumination of about 0.25 AM1 the hole's $\mu\tau$au is 6×10^{-6} cm^2/V while the electron's $\mu\tau$au is 2.6×10^{-9} cm^2/V. The lifetime dependence on the light intensity was found to be characterized by the exponent γ-1 = -0.44.

20082 Critical comparison of light-induced changes in sub-band-gap absorption and photoconductivity in hydrogenated amorphous silicon. Bhattacharya, E.; Mahan, A.H.; Crandall, R.S.; Pankove, J.I. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, Colorado 80401). *Applied Physics Letters;* **54**: No. 13, 1247-1249(27 Mar 1989).

This work compares changes in the density of states due to light-induced degradation estimated by photoconductivity with those measured by photothermal deflection spectroscopy (PDS) on a series of hydrogenated amorphous silicon (a-Si:H) films having different valence bandtail widths (E_0). We find that the photoconductivity measurements indicate orders of magnitude larger defect density changes than do the PDS measurements as the valence bandtail becomes broader. This conflict is resolved by showing that this difference is due to changes in the recombination rate coefficient K with valence bandtail width. The absolute change in K increases exponentially with E_0. However, the change in K relative to the K of the annealed state decreases with E_0, explaining why poor material shows a smaller light-induced effect.

20083 Long-range order in InAsSb. Jen, H.R.; Ma, K.Y.; Stringfellow, G.B. (Department of Materials Science and Engineering, University of Utah, Salt Lake City, Utah 84112). *Applied Physics Letters;* **54**: No. 12, 1154-1156(20 Mar 1989).

For the first time, {111} ordering (CuPt type) has been observed in $InAs_1$/sub -//sub x/Sb/sub x/ alloys in a wide compositional range from x = 0.22 to 0.88. The order-induced spots show the highest intensity for x≅0.5 samples and the lowest intensity toward each binary end compound. Only two of the four variants are formed during growth. In some areas the degree of order for these two variants is equal, and in other areas one variant dominates.

20084 Intense small wave-vector scattering from voids in amorphous silicon: A theoretical simulation. Biswas, R.; Kwon, I.; Bouchard, A.M.; Soukoulis, C.M.; Grest, G.S. (Microelectronics Research Center, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 8, 5101-5106(15 Mar 1989).

Voids of various sizes have been introduced into amorphous-silicon models that were generated with molecular-dynamics simulations. The presence of the voids leads to a rapidly increasing structure factor for wave vectors below 1 A/sup -1/ that is similar to the intense small-angle scattering observed in experiments. The voids cause only small changes in the vibrational densities of states. The presence of voids decreases the local strain in the a-Si networks, leading to a substantial reduction in the number of five-coordinated defect sites and a somewhat lower bond-angle strain from the a-Si model without voids. By comparing the properties of voids in crystalline and amorphous structures, we find the effect of decreasing the bond-angle disorder is to make the TO peak of the densities of states narrower and stronger, in agreement with Raman measurements.

20085 Cellular solutions for highly nonequilibrium directional solidification. Kessler, D.A.; Levine, H. (Department of Physics, University of Michigan, Ann Arbor, Michigan 48109). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 6, 3208-3210(15 Mar 1989).

We compute numerically the cellular shape expected for the directional solidification of CBr_4, at velocities far above the threshold for the Mullins-Sekerka instability. Our cell has a smooth tip plunging to a deep narrow channel which ends with a small liquid bubble. Our results are compared to the experimental findings of S. de Cheveigne, C. Guthmann, and M. M. Lebrun [J. Phys. (Paris) 47, 2095 (1986)].

20086 Dangling bonds in doped amorphous silicon: Equilibrium, relaxation, and transition energies. Branz, H.M. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, Colorado 80401). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 8, 5107-5115(15 Mar 1989).

The phenomenology of the dangling-bond defect in doped hydrogenated amorphous silicon (a-Si:H) is analyzed in a thermodynamic equilibrium framework with use of positive correlation energy and defect relaxation energies taken from previous theoretical calculations. Good agreement is obtained between theoretical predictions and the optical absorption, luminescence, and deep-level transient spectroscopy energies from the experimental literature. Because the charge and hybridization of the dangling bond in doped a-Si:H are known, considerable information about dangling-bond energy levels and relaxations in a-Si:H is obtained. The controversy over an anomaly of about 0.9 eV in the sum of n-type and p-type films' optical-absorption-peak energies is largely resolved by recognizing that the optical transitions are vertical. A small residual anomaly is taken as evidence for a small (~0.2 eV) electronic-level deepening caused by dopant-defect pairing or potential fluctuations. Comparison of defect optical and luminescence energies suggests Stokes shifts of 0.3 and 0.4 eV for the dangling-bond levels of n-type and p-type a-Si:H, respectively.

20087 Molecular-dynamics simulation of positive-ion and neutral halogen desorption following Na K-shell Auger cascades in the NaF crystal. Green, T.A.; Riley, M.E.; Coltrin, M.E. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185-5800). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 8, 5397-5406(15 Mar 1989).

A Na K-shell Auger cascade in NaF can produce either four to six neighboring valence holes, or two to four neighboring valence holes and a F^+ ion. If the holes remain localized as neutral atoms where they are created, they will assist the F^+ ion to desorb,

or assist in the desorption of Na^+ ions. The neutral atoms themselves may also desorb. We use molecular-dynamics calculations to investigate whether the F^+ ion and neutral F atoms produced by the Na K-shell Auger cascade in NaF can in fact lead to the desorption of positive ions and/or neutral F atoms. Simple fits to the Gordon-Kim potentials are used for the ionic interactions. Ab initio two-body potentials are developed to describe the interaction between a neutral F atom just outside of the crystal surface and a Na or F ion in the surface plane. The potentials exhibit a repulsive inner wall similar to that found for the diatomic molecules, and a shallow well. The integration time required for a satisfactory simulation of positive-ion desorption by the Knotek-Feibelman mechanism is shown to be 1—2 ps. Using 2-ps simulations, it is shown that only when the F^+ ion is accompanied by four neighboring F atoms from the same Auger cascade does positive-ion desorption occur from the perfect (100) surface. Analogous results are obtained in simulations designed to relate to the imperfect (100) surface. It is concluded that the neutral atoms assist positive ions to desorb only in configurations which appear to be too rare to be of experimental significance. It is shown that crystal temperature, near room temperature, is not a factor in determining whether positive-ion desorption occurs by the Knotek-Feibelman mechanism.

20088 **Auger-induced valence processes in alkali halides following alkali core-hole creation.** Green, T.A.; Riley, M.E.; Richards, P.M.; Loubriel, G.M.; Jennison, D.R.; Williams, R.T. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185-5800). *Physical Review [Section] B: Condensed Matter;* **39**: No. 8, 5407-5413(15 Mar 1989).

Ab initio calculated values are presented for the interatomic Auger and radiative decay rates for initial $(2p)^2$ and 2p hole states of the Na ion in NaF. A comparison of the rates shows that these hole states decay overwhelmingly by the nonradiative Auger process. The knowledge of the rates makes possible a clarification of the mechanism of photon-stimulated positive-ion desorption presented by Parks et al. [Phys. Rev. B 28, 4793 (1983)]. Following the creation of a Na(1s) hole in NaF, the ensuing Auger cascade results in the creation of four to six valence holes, or one F^+ ion and two to four valence holes, on the neighboring negative fluorine ions within an elapsed time of a few times 10/sup -14/ s. The majority of the valence holes are produced as hot holes, and are likely to diffuse several tens to hundreds of angstroms in times of the order of picoseconds before self-trapping to form V/sub K/ centers. The fast diffusion of these holes greatly reduces their chance of participating in ion desorption processes. The possibility that a fraction of the holes self-trap immediately and assist in the desorption of positive ions is considered. It is found that positive-ion desorption can occur if enough holes self-trap immediately. However, the required configurations are so special that they may occur with too small a probability to account for the observed positive-ion current. The fast hole diffusion also makes it unlikely that the V/sub K/ centers from the cascade will exhibit the clustering effects which would have been expected had the holes self-trapped in place.

20089 **Scanning tunneling microscopy of charge-density waves in $NbSe_3$.** Slough, C.G.; Giambattista, B.; Johnson, A.; McNairy, W.W.; Coleman, R.V. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). *Physical Review [Section] B: Condensed Matter;* **39**: No. 8, 5496-5499(15 Mar 1989).

The charge-density wave (CDW) structure in $NbSe_3$ due to the two independent CDW's has been imaged by scanning microscopy. As predicted by band-structure considerations, the CDW modulation is observed to be substantially localized on different chains for the separate CDW's. AT 77 K where only the high-temperature CDW exists, a relatively weak modulation with a single component along the b axis is observed. At 4.2 K the low-temperature CDW contributes a much stronger $\sim 4b_0 \times 2c_0$ superlattice modulation.

20090 **Unification of the properties of the EL2 defect in GaAs.** Hoinkis, M.; Weber, E.R.; Walukiewicz, W.; Lagowski, J.; Matsui, M.; Gatos, H.C.; Meyer, B.K.; Spaeth, J.M. (Center for Advanced Materials, Lawrence Berkeley Laboratory, Department of Materials Science, University of California, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **39**: No. 8, 5538-5541(15 Mar 1989).

We provide experimental unification of the properties of EL2 in GaAs, linking the measurements of optical absorption, deep-level transient spectroscopy, electron paramagnetic resonance (EPR), magnetic circular dichroism (MCD), optically detected electron-nuclear double resonance (ODENDOR). Results show that the EL2 defect has two energy levels, gives rise to the zero-phonon line in the neutral charge state, and gives rise to the EPR quadruplet, MCD, and ODENDOR signals in the singly ionized state. These manifestations disappear when EL2 is transferred to the metastable state. Any discussion of the properties of the EL2 defect must be consistent with these unified characteristics.

20091 **Comment on Temperature dependence of the 4f quadrupole moment of Yb in $YbCu_2Si_2$.** Rasul, J.W.; Schlottmann, P. (Department of Physics, Temple University, Philadelphia, Pennsylvania 19122). *Physical Review Letters;* **62**: No. 11, 1325-1325(13 Mar 1989).

A Comment on the Letter by V. Zevin, G. Zwicknagl, and P. Fulde, Phys. Rev. Lett. 60, 2331 (1988).

20092 **Structural inequivalence of the ion-damage—produced amorphous state and the glass state in lead pyrophosphate.** Sales, B.C.; Ramey, J.O.; Boatner, L.A.; McCallum, J.C. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6056). *Physical Review Letters;* **62**: No. 10, 1138-1141(6 Mar 1989).

The detailed structural changes that occur during ion-beam—induced amorphization of a solid have been experimentally determined for the first time using single-crystal surfaces of lead pyrophosphate that were implanted with varying doses of Pb/sup 3+/ ions. For all Pb-implant doses, the structure of the amorphous layer produced by ion bombardment was found to be significantly different than the structure of lead pyrophosphate glass prepared via thermal quenching.

20093 **Theory of high-pressure phases of hydrogen.** Barbee T.W. III; Cohen, M.L.; Martins, J.L. (Department of Physics, University of California, Berkeley, California 94720). *Physical Review Letters;* **62**: No. 10, 1150-1153(6 Mar 1989).

The electronic structure and enthalpy are calculated as a function of pressure for several phases of molecular and metallic hydrogen. For the molecular solid we offer an alternative interpretation of the recently observed transition at 1.5 Mbar. For the intermediate-pressure range from 3.8 +- 0.5 to 8.6 +- 1 Mbar, the most stable structures have low coordination numbers and are anisotropic. Among them a metallic filamentary primitive hexagonal phase is particularly stable. For higher pressures, the bcc structure is the most stable.

20094 **Unified theory of the mobilities of photoinjected electrons in naphthalene.** Kenkre, V.M.; Andersen, J.D.; Dunlap, D.H.; Duke, C.B. (Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico 87131). *Physical Review Letters;* **62**: No. 10, 1165-1168(6 Mar 1989).

We present a unified quantitative explanation of the temperature dependence of the drift mobilities of photoinjected electrons in naphthalene for all directions and temperatures. The theory proposed is based on a polaronic description of the charge carriers and the calculational scheme employs site-local states. Excellent agreement of the theory and experiment occurs for known and reasonable parameters.

20095 **Synchrotron studies of the first-order melting transitions of hexatic monolayers and multilayers in freely suspended liquid-crystal films.** Amador, S.; Pershan, P.S.; Stragier, H.; Swanson, B.D.; Tweet, D.J.; Sorensen, L.B.; Sirota, E.B.; Ice, G.E.; Habenschuss, A. (Division of Applied Sciences and Department of Physics, Harvard University, Cambridge, Massachusetts 02138). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2703-2708(1 Mar 1989).

Synchrotron x-ray diffraction has been used to study the surface and the interior hexatic-to-liquid (smectic-I to smectic-C) melting transitions of freely suspended liquid-crystal films of N-[4'-(n-heptyl)benzylidene]-4-(n-heptyl)aniline (7O.7) five molecular layers thick. Both the surface hexatic monolayers and the interior hexatic layers melt via hysteretic first-order transitions. After the two surface layers undergo a first-order transition to the smectic-I phase, the surface hexatic correlation length ξ evolves smoothly from $\sim$100 to $\sim$300 A with a roughly square-root form, $\xi\sim$chemical bondT-T/sub c/chemical bond/sup 1/2/.

20096 **In situ study of staging disorder in cesium-intercalated graphite.** Cajipe, V.B.; Heiney, P.A.; Fischer, J.E. (Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4374-4385(1 Mar 1989).

Staging structure and kinetics in cesium-intercalated graphite were studied in situ using x-ray diffraction. The stage disorder was characterized via detailed Hendricks-Teller model analyses of (00L) profiles corresponding to various stage configurations. Broad distributions of stages were obtained under equilibrium conditions. Both stage purity and phase separation decreased with decreasing concentration; stages 5 and higher were highly miscible, while stages 3 and 2 completely phase separated. The miscibility also varied nonmonotonically during a stage-n—to—(n-1) transition, suggesting that the kinetics are island-growth dominated towards the middle of the transition. We propose that the miscibility gap observed in a previous study of potassium graphite is caused by the enhanced development of stage-(n-1) cells with increasing chemical potential (or time), triggered by island growth; as these equilibrate, a discontinuously large stage-(n-1) volume results. Finally, an estimate for the exponent in the power-law repulsion between intercalate layers in alkali-graphite systems is made.

20097 **High-temperature lattice-liquid in-plane structure of LiC_6: A neutron scattering study.** Kim, H.J.; Magerl, A.; Soubeyroux, J.L.; Fischer, J.E. (Institut Laue-Langevin, 38042 Grenoble, France). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4670-4672(1 Mar 1989).

We studied the short-range Li ordering above the sublattice melting transition in the prototype graphite intercalation compound LiC_6. The fraction of locally commensurate Li above T/sub m/ was determined from the temperature dependence of the graphite G (100) structure factor. We used the fact that the thermal neutron scattering lengths of ^{6}Li and ^{7}Li are of opposite sign to show qualitatively that this fraction is close to unity; quantitative analysis places an upper bound of 10% on the incommensurate fraction. Thus, the disordered state of LiC_6 is characterized as essentially a lattice liquid, consistent with the relatively large commensurability energy.

20098 **Planar channeling in superlattices: Resonance channeling.** Allen, W.R.; Chu, W.K.; Picraux, S.T.; Biefeld, R.M.; Ellison, J.A. (Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina 27599-3255). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 3954-3958(1 Mar 1989).

A resonance effect is reported for planar channeling of MeV helium ions in a strained-layer superlattice. In addition to the well-documented catastrophic dechanneling which maximizes dechanneling, a novel resonance channeling effect has been observed that minimizes the dechanneling. These two contrasting phenomena are demonstrated in a single sample by varying the projectile energy for channeling along the inclined {110} planes of a GaAs/sub 0.8/P/sub 0.2//GaAs superlattice of equal-thickness layers. The resonance phenomena are measured and modeled theoretically as a function of ion energy and crystal strain.

20099 **Magnetic neutron scattering study of single-crystal cupric oxide.** Yang, B.X.; Thurston, T.R.; Tranquada, J.M.; Shirane, G. (Department of Physics, University of British Columbia, Vancouver, British Columbia, Canada V6T 2A6). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4343-4349(1 Mar 1989).

Among Cu/sup 2+/ compounds, cupric oxide (CuO) has unusual magnetic properties, some of which are shared by the superconducting copper oxides. In order to study these properties further, neutron scattering experiments on a CuO single crystal have been performed. Two magnetic phase transitions at T/sub $N/_1$ = 231 K and T/sub $N/_2$ = 212.5 K have been observed, with the magnetic structure below T/sub $N/_2$ antiferromagnetic and the structure between T/sub $N/_1$ and T/sub $N/_2$ helical in nature. The dynamics of the magnetism was also studied. As in La_2CuO_4, the dispersion of the low-temperature spin-wave excitations is unusually steep (dE/dk = 250 +- 75 meV A/sup -1/), indicating strong magnetic interactions. Inelastic magnetic scattering has also been measured above T/sub $N/_1$. At temperatures slightly above the 231-K phase transition, dynamic critical slowing has been observed.

20100 **Specific heat of the random-field Ising system Fe/sub 0.46/Zn/sub 0.54/F_2.** Dow, K.E.; Belanger, D.P. (Department of Physics, University of California, Santa Cruz, California 95064). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4418-4423(1 Mar 1989).

Heat pulse specific-heat measurements are compared with data from optical linear birefringence techniques in the dilute antiferromagnet Fe/sub 0.46/Zn/sub 0.54/F_2 for applied magnetic fields H$\leqq$1.5 T. The optical technique is shown to reproduce the dynamically rounded symmetric specific-heat peak for Hnot =0. Hysteretic effects resulting from cooling the sample in the field are observed in a similar manner for both techniques. The relationship to previous specific-heat measurements in other random-field systems is discussed.

20101 **Analytical evaluation of interfacial shear strength for fiber-reinforced ceramic composites.** Hsueh, C.H. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Journal of the American Ceramic Society;* **71**: No. 6, 490-493(Jun 1988).

A methodology is described to evaluate the shear strength at the fiber-coating interface. Stress analyses are performed for the following system: a fiber with a uniform coating in its central portion which is subjected to an axial tensile stress through its bare ends. The results show that the axial tensile stress in the coating decreases with the increase in the thickness of the coating and that the interfacial shear stress exhibits the opposite trend. Hence, a critical thickness of the coating can be defined depending on the properties of the material, such that when the coating thickness is less than the critical value, failure of the composites initiates from segmentation of the coating during tensile loading, Conversely, when the coating thickness is greater than the critical value, debonding of the interface occurs. Furthermore, the interfacial shear strength can be related to this critical thickness and the tensile strength of the coating.

20102 **Aging effects in extruded polycrystalline thallium bromo-iodide fibers.** Wysocki, J.A.; Schwartz, R.N.; Standlee, A.G.; Wilson, R.G.; Williams, A.R. (Hughes Research Labs., 3011 Malibu Canyon Road, Malibu, CA (US)). pp v of Infrared optical material and fibers V. Klocek, P. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1987). (CONF-8708223—).

From Infrared optical materials and fibers V; San Diego, CA, USA (20 Aug 1987).

Optical aging in bulk and extruded fibers of thallium bromo-iodide is discussed. In particular, changes in optical attenuation with age are correlated with the physical properties of the material.

20103 **Plasma deposition of tungsten.** Greenberg, K.E. (Sandia National Labs., Albuquerque, NM (US)). pp v of Photon, beam, and plasma stimulated chemical processes at surfaces. Donnelly, V.M.; Herman, I.P.; Hirose, M. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612130—).

From Materials Research Society symposium on photon, beam and plasma stimulated chemical processes at surfaces; Boston, MA, USA (1 Dec 1986).

Tungsten films were plasma-deposited using an abnormal glow discharge through a mixture of tungsten hexafluoride, hydrogen, and argon. The films adhered well to silicon, silicon dioxide, gallium arsenide, and aluminum substrates placed directly on the discharge cathode. Typical deposition rates were on the order of 160 Angstroms/minute with as-deposited film resitivities of 40 to 70 microohm-cm. The tungsten was analysed using a number of techniques including X-ray diffraction, scanning electron microscopy, and Auger spectroscopy. Low-resistivity (<10 microohm-cm) films that adhered well to silicon-dioxide were obtained with a two-step process utilizing plasma deposition and conventional chemical vapor deposition.

20104 **Etching of LiNbO/sub 3/ by laser-driven fusion of salts.** Ashby, C.I.H.; Brannon, P.J. (Sandia National Labs., Div. 1126, P.O. Box 5800, Albuquerque, NM (US)). pp v of Photon, beam, and plasma stimulated chemical processes at surfaces. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612130—).

From Materials Research Society symposium on photon, beam and plasma stimulated chemical processes at surfaces; Boston, MA, USA (1 Dec 1986).

Lithium niobate exhibits low reactivity with most chemical etchants. Consequently, etching a LiNbO/sub 3/ surface to produce optical structures such as ridge waveguides or grooves for fiber coupling normally requires relatively slow processes such as ion milling. The authors have developed a laser-driven chemical etching process for etching highly unreactive ionic solids based on the fusion of salts in the molten phase and show that the etch rate can be more than 100 times faster than ion milling rates. This process involves spatially localized melting of LiNbO/sub 3/ by high-power density laser pulses with photon energies in excess of the band gap of LiNbO/sub 3/. While molten, LiNbO/sub 3/ undergoes reaction with a surface coating of KF to form niobium oxyfluoride anions by fusion of the salts. The resulting solid is highly water soluble. The insolubility of LiNbO/sub 3/ permits subsequent removal of only the irradiated area by rinsing in water. Surface morphology is determined by laser power density. The process exhibits a wavelength dependence.

20105 **Comparison of low intensity laser enhancement of oxygen chemisorption on GaAs using O/sub 2/ and N/sub 2/O.** Bertness, K.A.; McCantis, C.E.; Chiang, T.T.; Mahowald, P.H.; Wahi, A.K.; Kendelewicz, T.; Lindau, I.; Spicer, W.E. (Stanford Electronics Labs., Stanford Univ., Stanford, CA (US)). pp v of Photon, beam, and plasma stimulated chemical processes at surfaces. Donnelly, V.M.; Herman, I.P.; Hirose, M. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612130—).

From Materials Research Society symposium on photon, beam and plasma stimulated chemical processes at surfaces; Boston, MA, USA (1 Dec 1986).

The sticking coefficient for molecular oxygen on GaAs up to about one-half monolayer coverage can be enhanced by two or three orders of magnitude when the semiconductor surface is illuminated by an argon ion laser with intensities of 5 W/cm/sup 2/ or less. Previous work has shown that this effect is nonthermal and roughly independent of wavelength for above-bandgap radiation, implying that photogenerated electrons and/or holes are responsible in some way. In this paper, the authors present recent work which shows that transfer of energy from the GaAs to oxygen molecules physisorbed on the surface causes the breakup of the oxygen and so enhances the reaction. This conclusion comes from comparison of their photoemission results for O/sub 2/ and N/sub 2/O exposures made under the same conditions, N/sub 2/O being chosen since only 1.7eV is needed to remove the oxygen atom as opposed to the 5.1eV required to break an O-O bond. Nitrous oxide, in contrast to O/sub 2/, shows only slight photoenhancement and has a much lower activation energy for the dissociative sticking coefficient, demonstrating that removal of the dissociation of O/sub 2/ as a reaction step also removes the major part of the activation energy barrier to oxygen chemisorption. Since N/sub 2/O and photoenhanced O/sub 2/ have similar kinetics, we conclude that the breakup of O/sub 2/ is the reaction step accelerated by illumination. Another clue to the nature of the photoenhancement comes from our finding that both n- and p-type GaAs display similar O/sub 2/ laser enhancement ratios. An estimate of the carrier concentrations at the surface predicts that electrons and holes are present in equal amounts at the surfaces of both doping types, however, so this result does not distinguish between single-carrier and recombination-related enhancement mechanisms.

20106 **Mechanisms for the deposition of thin metallic films by laser driven gas phase reactions.** Jervis, T.R.; Menon, S.K.; Joyce, E.L.; Carroll, D.W. (Materials Science and Technology Div., Mailstop E549, Los Alamos National Lab., Los Alamos, NM (US)). pp v of Photon, beam, and plasma stimulated chemical processes at surfaces. Donnelly, V.M.; Herman, I.P.; Hirose, M. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612130—).

From Materials Research Society symposium on photon, beam and plasma stimulated chemical processes at surfaces; Boston, MA, USA (1 Dec 1986).

Gas phase processing makes laser deposition over large areas possible but homogeneous nucleation of large atomic clusters must be avoided if films are to be produced. Clusters can be highly variable in size from a few atoms to significant fractions of a micrometer. If conditions do not allow for complete quenching of the clusters produced in the gas phase, these clusters can arrive at the substrate with sufficient energy to self sinter into homogenous films which are substantially different from metallic films grown by thermal techniques. Using transmission electron microscopy (TEM), the authors have characterized the microstructure of thin metallic films deposited by laser breakdown chemical vapor deposition and identified a range of deposition conditions which can lead from powders to homogeneous polycrystalline films and mixed phase materials. Gas phase nucleation is dependent on reactant partial pressures and the gas phase quench rate which can be varied in part by adjusting the H/sub 2/ content of the source gas. Manipulation of these parameters can vary powder size from about one micrometer to less than 2 nanometers. Variation of the quench rate during the deposition of polycrystalline films varies the grain size in the films. Heating the substrate drastically changes the conditions under which the film is formed and as a consequence, can radically alter the microstructure of the film itself.

20107 **Synthesis of the dilute magnetic semiconductor CdMnTe by ion implantation of Mn into CdTe.** Braunstein, G.H.; Heiman, D.; Withrow, S.P.; Dresselhaus, G. (Massachusetts Institute of Technology, Cambridge, MA (US)). pp v of Diluted magnetic (semimagnetic) semiconductors. Aggarwal, R.L.; Furdyna, J.K.; Von Molmar, S. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612132—).

From Materials Research Society symposium on diluted magnetic (semimagnetic) semiconductors; Boston, MA, USA (1 Dec 1986).

The dilute magnetic semiconductor CdMnTe has been synthesized by ion implantation of Mn into CdTe. Samples of CdTe have been implanted with Mn ions of 60 keV energy to fluences in the range 1 x 10/sup 13/cm/sup -2/ to 2 x 10/sup 16/cm/sup -2/ and subsequently annealed, using rapid thermal annealing, for 10 - 15 sec at temperatures 300 δ T/sub A/ δ 730°C. The successful formation of a near surface layer of CdMnTe is demonstrated by studies of the structural, electronic, and magnetic properties of the ion implanted and annealed samples; Rutherford backscattering-channeling analysis of the radiation-induced damage indicates complete recovery of lattice order after annealing at 700°C. Photoluminescence measurements, performed at 2 K, reveal an increase in the energy band gap of the ion implanted alloy with respect to CdTe. Application of magnetic fields, up to 8T, produce both the characteristic energy shift of the excitonic recombination peak and polarization of the emitted radiation (in the Faraday configuration) previously observed in bulk-grown CdMnTe material.

20108 **A model for silicon dendrite growth during laser/plasma deposition from a silane discharge.** Anderson, H.M.; Hargis, P.J. Jr. (Dept. of Chemical and Nuclear Engineering, Univ. of New Mexico, Albuquerque, NM (US)). pp v of Photon, beam, and plasma stimulated chemical processes at surfaces. Donnelly, V.M.; Herman, I.P.; Hirose, M. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612130—).

From Materials Research Society symposium on photon, beam and plasma stimulated chemical processes at surfaces; Boston, MA, USA (1 Dec 1986).

A model for dendrite growths in polycrystalline Si films formed during laser/plasma deposition with a silane discharge and a pulsed KrF laser has been developed. The model assumes a thin (less than 10 nm) amorphous silicon (a-Si) film is deposited on a substrate prior to phase transformation due to laser heating. The observed dendritic structure of the overall polycrystalline Si films is attributed to Si crystals shooting from an excessively supercooled Si liquid bath. Supercooled liquid forms since the melting point for a-Si can be reached at relatively low KrF laser fluences. Latent heat evolved at the solid-liquid interface induces an interface temperature higher than that of the melt and the requisite negative temperature gradient for absolute bath supercooling. Since the formation of an undercooled liquid by fast melting a-si is also an important first step in explosive crystal regrowth studies, these results may have important implications for crystal growth and transient annealing. A conical approximation model is used in this study to characterize the stability of the dendrite tip in terms of local temperature gradients, i.e., the degree of undercooling at the tip of the parabolic dendrite. The degree of undercooling and hence the top radius appears to be significantly affected by small changes in the laser fluence. Stability criteria lead to a relationship between regrowth velocity, V, and the tip radius R, of the form VR/sup 2/ = constant. The size and stability of the dendrite tip is determined from a balance between the destabilizing force due to thermal diffusion and the stabilizing capillary force. Based on the observed tip radii formed at laser fluences from 0.13 to 0.25 J/cm/sup 2/, the model predicts regrowth velocities in a range between 2.0 and 20m/s -- values consistent with transient annealing studies of a-Si.

20109 **Relationships among retardation, expansion, microstructure, and phase composition for a salt-saturated expansive grout.** Wakeley, L.D. (Waterways Experiment Station, P.O. Box 631, Vicksburg, MS (US)). pp v of Microstructural development during hydration of cement. Struble, L.J.; Brown, P.W. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612169—).

From Workshop on the origins of solar systems; Queenstown, MD, USA (15 Dec 1986).

A salt-saturated and sulfate-expansive grout was formulated with four levels of sodium citrate to determine effects on workability and setting time. Linear expansion of restrained grout prisms increased with amount of citrate used, apparently a function of extent of retardation of the grouts. This relationship was observed both for grouts cured for at least 53 days, and for a concrete formulated from the same cementitious materials cured for at least 180 days age. The microstructure of the grouts at 28 days showed notable increases in extent of reaction of the sulfate phases and in formation of ettringite with increasing citrate content, and thus with increasing retardation of set. XRD also revealed an increase in well-crystallized ettringite and decrease in gypsum with greater retardation. These observations provide a microstructural and compositional link between retardation and expansion of cementitious materials formulated to be expansive.

20110 **Photo-inhibition of passivity breakdown on nickel.** Macdonald, D.D.; Lenhart, S.J.; Urquidi-Mcdonald, M. (Chemistry Lab., SRI International, Menlo Park, CA (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

An essential step in the initiation of localized corrosion on metal and alloy surfaces is the breakdown of the passive film. Many studies have been carried out to measure the critical breakdown voltage (V/sub c/) and induction time (t/sub ind/) for pit initiation in a wide variety of environments. Until recently, it was believed that passivity breakdown for any given alloy/environment system could be described in terms of a single (V/sub c/,t/sub ind/) pair. However, more recent studies, including both experimental and theoretical work (1-6) have demonstrated that both V/sub c/ and t/sub ind/ are distributed parameters, presumably due to the inhomogenous nature of the surface. During the course of the authors' current program to investigate the role of minor alloying elements on passivity breakdowns, they have measured distributions in the breakdown voltage for pit initiation on nicel in buffered (ph = 9.2) 2m NaCl solution by photographing the surface of the electrode microscopically at regular time intervals during potentiodynamic polarization at 1 mV/s. The passive film was initially grown in a chloride-free, pH 9.2 borate buffer solution (0.25 m KOH/0.5m B(OH)/sub 3/) at 25°C for one hour, to preclude incorporation during the film growth period. Pitting observations were made photographically by illuminating the metal surface with white light obtained from a tungsten filament lamp. In performing these measurements, they have noted that the distribution in the breakdowns voltage depends upon the intensity of the light that impinges on the metal surface. To their knowledge, photo effects in passivity breakdown have not previously been reported.

20111 **A basic study of heat transfer through foam insulation.** Schuetz, M.A.; Glicksman, L. (Owens-Corning Fiberglass Corp., Technical Center, Granville, OH (US)). pp v of Advances in foam aging: A topic in energy conservation. Volume I. Brandreth, D.A. Yorklyn, DE; Caissa Editions (1986).

Heat transfer through foam insulation was investigated theoretically and experimentally. Conduction through the gas, conduction through the solid, and radiation were studied. The effect of coupling of the mechanisms was found to be small, allowing each mechanisms was found to be small, allowing each mechanism to be modeled separately. Conduction through the solid accounts for approximately 11 to 21 percent of the heat transfer through low density isotropic foam. The magnitude is insensitive to cell shape except for when the cells are highly elongated. Solid material located in cell wall membrane conducts twice as much heat as the same amount of material located in struts, linear elements formed at the intersection of the cell membranes. Radiation is a substantial contributor to the foam heat transfer, accounting for 15 to 27 percent of the total in fresh low density foams. Detailed radiation characteristics of the foam were measured; the results can be closely approximated by a simple model requiring a straightforward measurement of the foam transmissivity. An accurate but simple model for the overall R value of foam is presented. The model requires a minimum number of experimentally determined foam properties, and hence, should be useful in research to produce higher R value foams, as well as in relating gas diffusion rates to changes in foam R value.

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20112 **(EPRI-GS—6258) Quality assurance and quality control for environmental laboratories: Design guidelines: Final report.** Scott, J.W. (Electric Power Research Inst., Palo Alto, CA (USA); TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div.). Mar 1989. 238p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

As aqueous discharge monitoring requirements continue to expand in scope and complexity, utility laboratories face added pressures in demonstrating their capabilities to meet these requirements. To accurately determine permit parameters at the low concentrations required, consistent control of laboratory variables through an effective quality assurance/quality control (QA/QC) program is essential. This report presents guidelines for use in utility laboratories when QA/QC programs are in the process of being developed or re-evaluated for possible improvements. The information presented combines the results of literature review and numerous interviews of utility personnel about strengths and shortcomings of current quality assurance practices. In addition,EPA personnel at national, regional, and state levels were questioned about the quality assurance requirements faced by the laboratories. Visits were made to selected laboratories with effective quality assurance

programs to discuss the logistics of making quality assurance happen, both in central laboratories as well as in station laboratories. 60 refs., 23 figs., 20 tabs.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 19298, 19312, 19321, 19378, 19978, 20037, 20190, 20558, 20788, 21318, 21318

20113 **(ANL/ACL—88-1) Analytical Chemistry Laboratory: Progress report for FY 1988.** Green, D.W.; Heinrich, R.R.; Graczyk, D.G.; Lindahl, P.C.; Erickson, M.D. (Argonne National Lab., IL (USA). Analytical Chemistry Lab.). Dec 1988. Contract W-31109-ENG-38. 49p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008089/JAW.

The purpose of this report is to summarize the activities of the Analytical Chemistry Laboratory (ACL) at Argonne National Laboratory (ANL) for fiscal year 1988 (October 1987 through September 1988). The Analytical Chemistry Laboratory is a full-cost recovery service center, with the primary mission of providing a broad range of analytical chemistry support services to the scientific and engineering programs at ANL. In addition, the ACL conducts a research program in analytical chemistry, works on instrumental and methods development, and provides analytical services for governmental, educational, and industrial organizations. The ACL handles a wide range of analytical problems, from routine standard analyses to unique problems that require significant development of methods and techniques.

20114 **(ANL/PPRNT—89-114) Cesium-133 NMR studies of cation siting and site exchange dynamics in hydrated Cs-Na-A zeolite.** Ahn, Myong-Ku; Iton, L.E. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008454/JAW.

Variable temperature Cs-133 NMR measurements have been made on hydrated Cs-exchanged Linde-4A zeolite containing 3.8 Cs^+ ions per unit cell. At room temperature there is rapid site exchange of the Cs^+ ions, so that the NMR spectrum is that of a single time-averaged environment. At temperatures below 238 K, the exchange is slowed sufficiently to permit the resolution of two resonances. These resonances can readily be assigned to Cs^+ ions at 8-ring sites and 6-ring sites, which are distinguished by their large chemical shift difference of 106 ppM in the zeolite. The lifetimes and the population ratio of 2.3 for the two Cs^+ ion sites are obtained by fitting the NMR lineshapes at various temperatures using a set of modified Bloch equations for a two site exchange process. An Arrhenius activation energy of 38 kJ/mol for the cationic site exchange process in A-type zeolite is obtained from the lifetimes of Cs^+ ions. The rapid rate of site exchange established unequivocally that the 6-ring ion is on the α-cage side of the ring. 33 refs., 2 figs., 1 tab.

20115 **(ANL/PPRNT—89-161) Variable-temperature magic-angle-spinning technique for studies of mobile species in solid state NMR.** Tokuhiro, Tadashi; Mattingly, M.; Iton, L.E.; Ahn, M.K. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008346/JAW.

We demonstrate the utility of variable-temperature (VT) magic-angle-spinning (MAS) Fourier transform nuclear magnetic resonance (FT-NMR) spectroscopy for the study of mobile species in solids, especially when quadrupolar nuclei are being observed. A new VT-MAS probe is described for use in the temperature range 150 - 400 K, using spectrometers with high-field superconducting magnets. It has been utilized in studies of the bonding and dynamics of alkali cations in hydrated zeolites at an applied field of 7.05 T. Results are presented for the cases of Cs/Na-A and Cs/Li-A zeolites, in which the Cs^+ ions exchange rapidly, at 293 K, between six-ring and eight-ring sites in the large cage, so that on the time scale of the NMR measurements the ions are indistinguishable and a single ^{133}Cs resonance is observed. Below 250 K, two well-resolved signals are observed in the Cs/Na-zeolite, 107 ppM apart. These are easily assigned to the Cs^+ ions in the two sites, the large difference in chemical shifts being attributed to the stronger bonding of Cs^+ ions at the six-ring sites. Three sites are distinguished in the Cs/Li-A zeolite, the third site being assigned to a position near to a four-ring in the large cage. 26 refs., 3 figs., 1 tab.

20116 **(CBPF-NF—069/87) Stone tools associated with middle pleistocene fauna in the Toca da Esperanca, central region, Bahia state, Brazil.** Lumley, H. de; Lumley, M.A. de; Beltrao, M.C.M.C. and others. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1987. 43p. (In French). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705412/JAW.

Excavations /sup (1/) organized on a 12 m/sup 2/ surface have exhumed quaternary deposits under a 50 cm carbonate crust (layer I). These deposits were composed of angular broken stones compacted into breccia (layer II), yellowish sand (layer III) and reddish clayey sand (leyer IV), containing fossilized bones. These bones belong to extinct quaternary species, in particular Equidae. The uranium-thorium method was used to date several bone samples found in situ which gave these faunas an age of about 300,000 years. Several quartzite stone tools as well as fragments of quartzite and quartz pebbles were discovered among the fossil bones. In particular, the fragment of a pebble, broken by violent percussion and a chopper were found. The raw materials, quartzite and quartz, naturally absent from the cave could only have been brought there by prehistoric man. The Toca da Esperanca is, therefore, the most ancient site known on the American continent which contains evidence of early man. It provides evidence of human presence from the Middle Pleistocene period, about 300,000 years ago, well before the Calico sites in California (about 200,000 years) and the Santa Raimundo Nonato sites (about 30,000 years). In the light of these new discoveries, it is possible to surmise that Homo Erectus came from Asia very early during the Middle Pleistocene, passing the Behring Strait, during one of the big recessions in ocean levels which took place in the cold quaternary periods.

20117 **(CEA-CONF—9662) FLUO 2001: a new spectrofluorometer with detection by a pulsed photodiode file.** Mauchien, P.; Moulin, C.; Decambox, P.; Kirsch, B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques). May 1988. 6p. (In French). (CONF-8805121—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756989/JAW.

From OPTO '88; Paris, France (17 May 1988).

The utilization of the FLUO 2001 spectrofluorimeter for uranium dose measurement in various types of sample (medical, geological, nuclear, pure materials) is presented. The detection threshold for uranium in a simple matrix is 1 ng/liter (1 ppt). Certain lanthanides (Eu, Tb, Dy, Sm) can be detected at ppb concentrations. Detection thresholds and lifetimes of these molecules are shown. Fiber optics adaptation is possible without any loss of sensitivity and allows in situ measurements in hostile environments or in cases where access is difficult.

20118 **(CEA-CONF—9664) Nuclear microprobe analysis. Application to the volcanic glasses.** Mosbah, M.; Tirira, J.; Trocellier, P.; Metrich, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. de Chimie Appliquee et d'Etudes Analytiques; Laboratoire d'Analyse par Activation Pierre Sue, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR)). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques). 1988. 14p. (CONF-8808201—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756990/JAW.

From International congress of geochemistry and cosmochemistry; Paris, France (29 Aug 1988).

The determination of CO/sub 2/ and H/sub 2/O content of magma prior to the eruption and collected in crystallised components give us an indication more or less accurate about the depth and the chemical composition of silicated melt. The two components CO/sub 2/ and H/sub 2/O are deduced from glassy inclusions trapped in minerals during crystal growth. Development and improvement of nuclear microanalyses were performed, carbon

content is easily analysed, analysis of hydrogen is possible but need more time and more experiments.

20119 **(CEA-tr—2305) Fluorimetric determination of samarium and europium by the micellar system 2. thenoyltrifluoroacetone/1.10. phenantroline.** Huang, H.G.; Geng, X.X. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1988. 9p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756996/JAW.

Fluorimetric analysis of Sm and Eu using TTA and phen with a non ionic surfactant is described. In this method phen replaces TOPO which is more expensive. Sm and Eu are determined with great sensitivity in aqueous solution and extraction by organic solvents is not required.

20120 **(DOE/ER/13678—15) Removal of dissolved metals from water using micellar-enhanced ultrafiltration.** Scamehorn, J.F.; Christian, S.D. (Oklahoma Univ., Norman (USA). Inst. for Applied Surfactant Research). 1988. Contract FG05-87ER13678. 10p. (CONF-8801133—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005141/JAW.

From American Electroplaters Societies Foundation aerospace plating symposium; Orlando, FL, USA (25 Jan 1988).

Micellar-enhanced ultrafiltration (MEUF) is a novel technique to remove dissolved heavy metals from water by addition of ionic surfactant. Positively charged metal cations bind onto negatively charged surfactant aggregates (micelles) when anionic surfactants are used; negatively charged metal complexes can be bound onto positively charged micelles using cationic surfactants. In addition to the metal binding, dissolved organics solubilize or dissolve in the micelles. The solution is then passed through an ultrafiltration membrane which blocks the micelles, resulting in pure permeate water. The ability of this technique to remove divalent metal cations and divalent anionic metallic complexes from water is demonstrated in this work, either as individual metals or as mixtures of metals. A 500-fold reduction in metal concentration can be attained in one pass. Simultaneous removal of metals and organics is demonstrated. The effect of important operating variables on performance is also discussed. 10 refs., 3 figs., 3 tabs.

20121 **(ENEA-RT-COMB—88-4) Liquid-liquid extraction of actinides by means of dibutyl-N, N-diethylcarbamylphosphanate (DBDECP).** Spezzano, P.; Giacomelli, R.; Sarzanini, C.; Volpe, P.; Benzi, P. (ENEA, Saluggia (Italy). Centro Ricerche Energia; Turin Univ. (Italy). Dipt. di Chimica Analitica; Turin Univ. (Italy). Ist. di Chimica Generale e Inorganica). (ENEA, Rome (Italy)). 1988. 42p. (In Italian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705433/JAW.

The extraction of Th(IV), U(VI), Pu(IV), Am(III) and Cm(III) by dibutyl-N, N-diethylcarbamoylphosphonate (DBDECP) from notric, hydrochloric and perchloric acid solutions has been studies as a function of a number of parameters. The effect of size and structure of the extractant molecules has been investigated for lower homologues of carbamoyphosphonate. After evaluating the effect of the diluent, the extraction of inorganic acid HNO/sub 3/, HCl and HClO/sub 4/ and the dipendence of the distribution ratios of the actinides from organic extractant concentration and aqueous acid concentration has been studied for the DBDECP-xilene system. 17 refs.

20122 (INIS-BR—1411, pp 90-101) **Criteria for requesting specific radionuclide analysis through gross α and gross β concentration measurements in environmental samples.** Ferreira, E.G. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

This paper suggests some criteria for the decision to proceed with the analysis of specific radionuclides based on results of the determination of gross α and β concentrations in environmental samples of aerosols, water, dairy and agricultural products, soil and sediments. The samples considered are from the environmental surveillance of uranium mining and milling facilities as well as the mining and processing plants of monazite sands. The radionuclides to be analysed are those considered to be the most critical to human health, that is: U-nat; Th-nat; Th-230; Ra-228; Ra-226; Po-210; Pb-210. The measured gross α and β concentrations will be compared with the Maximum Allowable Concentrations for some defined radionuclides. Radiochemical analysis of specific radionuclides may then become necessary, depending upon the results of this comparison. The main goal of the proposed guide is to simplify and to discipline the execution of environmental surveillance programs in a safe and economical way, avoiding unnecessary analysis.

20123 **(INIS-BR—1434) Determination of molybdenum in steels by ETAAS using electrical dispersed samples.** Eljuri, E.; Torres, M.; Fernandez, A.; Carrion N. (Universidad Central de Venezuela, Caracas. Escuela de Quimica). (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). 1988. 2p. (CONF-8809294—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705757/JAW.

From 1. Rio symposium on furnace atomic absorption spectrometry; Rio de Janeiro, Brazil (18 Sep 1988).

20124 **(INIS-BR—1435) Determination of minor and trace metallic components of Venezuelan red mud by graphite furnace atomic absorption spectrometry.** Alvarado, J.; Petrola, A. (Universidad Simon Bolivar, Caracas (Venezuela). Dept. de Quimica). (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). 1988. 2p. (CONF-8809294—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705758/JAW.

From 1. Rio symposium on furnace atomic absorption spectrometry; Rio de Janeiro, Brazil (18 Sep 1988).

20125 **(INIS-BR—1436) Advances and prospects in absorption spectrometry of traces.** Prudnikov, E.D. (State Univ., Leningrad (USSR). Earth's Crust Institute). (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). 1988. 2p. (CONF-8809294—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705759/JAW.

From 1. Rio symposium on furnace atomic absorption spectrometry; Rio de Janeiro, Brazil (18 Sep 1988).

20126 **(INIS-BR—1437) Determination of trace amounts of rare earth elements in rare earth matrix by graphite-furnace atomic absorption spectrometry.** Dantas, E.S.K.; Atalla, L.T. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). 1988. 2p. (CONF-8809294—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705760/JAW.

From 1. Rio symposium on furnace atomic absorption spectrometry; Rio de Janeiro, Brazil (18 Sep 1988).

20127 **(INIS-BR—1438) Investigations of chemical reactions of oxide forming elements in the graphite furnace AAS.** Mueller-Vogt, G.; Wendl, W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Physik). (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). 1988. 1p. (CONF-8809294—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705761/JAW.

From 1. Rio symposium on furnace atomic absorption spectrometry; Rio de Janeiro, Brazil (18 Sep 1988).

20128 (INIS-BR—1439, pp 5) **Intercalar compounds from niobium and tantalum.** Wypych, F.; Tsunoda, M. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20129 (INIS-BR—1439, pp 84) **Determination of Zr, Hf and Fe using x-rays fluorescence in aqueous and organic phases in the zirconium purification process.** Scapin Junior, W.S.; Salvador, V.L.R.; Sato, I.M.; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20130 (INIS-BR—1439, pp 18) **Reaction between trifluoromethane sulphate of lanthanides and 3-pycoline-N-oxide (3- picNO).** Zinner, L.B.; Mutarelli, S.R. (Sao Paulo Univ., SP (Brazil). Inst. de Quimica). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20131 (INIS-BR—1439, pp 49) **Characterization of bronze - aluminuim alloy using x-ray fluorescence.** Salvador, V.L.R.; Sato, I.M.; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20132 **(INIS-BR—1439) Proceedings of the 27. Brazilian Congress on Chemistry.** (Associacao Brasileira de Quimica, Rio de Janeiro, RJ). 1987. 119p. (In Portuguese). (CONF-8710449—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW.

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

Some works on separation methods of lanthanides, as well as others elements of nuclear use, are presented. Studies on extraction behaviour and the chemical nature of the extraction products are shown. (M.J.C.).

20133 (INIS-BR—1439, pp 14) **Implantation, standardization and calibration of a spectrophotometric method for uranium determination in samples of safeguards.** Araujo, R.M.S. de; Silva, S.P. da. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20134 (INIS-BR—1439, pp 53) **Determination of lanthanide elements in rare earths concentrated by emission spectrometry with plasm source (ICP).** Paula Reino, L.C. de; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20135 (INIS-BR—1439, pp 100) **Spectrophotometric determination of uranium, thorium and zirconium in rocks and samples of processes.** Medeiros, J.A.; Ferreira, A.C.M.; Roldao, L.A.F.; Duarte, L.T.; Sales, H.B.; Dutra, H.Z.; Andrade, M.G.M.; Carvalho, M.L.C.P. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ; Rio de Janeiro Univ., RJ (Brazil); Bahia Univ., Salvador (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20136 (INIS-BR—1439, pp 101) **Analysis on rocks and metallic alloys by ion exchange with determination of main elements by gravimetry using microwaves.** Medeiros, J.A.; Ferreira, A.C.M.; Sales, H.B.; Dutra, E.Z.; Carvalho, L.M. de; Ferreira, E.M.M.; Duarte, L.T.; Aquino, Z.N. de. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20137 (INIS-BR—1439, pp 10) **Determination of nuclear fuel enrichment, using neutron activation analysis and the statistical technique "bootstrap".** Almeida, M.C.M. de; Carvalho, J.L.S. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20138 (INIS-BR—1439, pp 48) **Determination of contaminants in boric acid used as neutrons moderator using ions and selective eletrode chromatography.** Pires, M.A.F.; Abrao, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20139 (INIS-mf—11356, pp 43) **Determination of the total contents and the availability of elements in a forest soil by instrumental neutron activation analysis.** Bajo, S.; Tobler, L.; Wyttenbach, A. (Paul Scherrer Institut, Wuerenlingen (Switzerland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20140 (INIS-mf—11356, pp 59) **Trace and minor element determination in soil and plant materials by neutron activation analysis.** Buchtela, K.; Grass, F.; Ismail, S.S. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20141 (INIS-mf—11356, pp 170) **Multielement investigations of fertilizer phosphates by means of instrumental neutron activation analysis (INAA).** Schnier, C.; Niedergesaess, R.; Pepelnik, R.; Schnug, E. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik; Kiel Univ. (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20142 (INIS-mf—11356, pp 150) **Irradiation facilities for neutron activation analysis in Dubna.** Nagy, A.Z. (Univ. of Agricultural Sciences, Physics Department, Goedoelloe (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20143 (INIS-mf—11358, pp 63) **Prompt gamma neutron activation analysis (PGNAA) at Safari-1.** Hofmeyr, C. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

20144 **(IPEN-PUB—204) Determination of /sup 235/U//sup 238/U and /sup 234/U//sup 238/U isotopic ratios by alpha spectrometry.** Saiki, M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Sep 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705547/JAW.

Alpha spectrometry has been applied to the determination of /sup 235/U//sup 238/U and /sup 234/U//sup 238/ isotopic ratios in uranium standard reference materials from COGEMA and NBS. The sources were prepared by electrodeposition on stainless steel and the alpha activities measured with a ruggedized detector. In the /sup 235/U//sup 238/U isotopic ratio determination, the best results were obtained with the standards enriched in /sup 235/U. A relative error down to 0.5% (COGEMA standard) and a precision of about 1% (NBS and COGEMA standards) were obtained for uraniun standards enriched in /sup 235/U. A precision down to 0.8% (COGEMA standard) and a relative error of about 1% (NBS and COGEMA standards) were obtained in the /sup 234/U//sup 238/U ratio determinations for standards containing high percentages of /sup 234/U and /sup 238/U atoms.

20145 **(IPEN-PUB—206) Mass determination of U-233 and Pu-239 by gamma spectrometry technique.** Moraes, M.A.P.V. de; Pugliesi, R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Sep 1988. 13p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705548/JAW.

The gamma spectrometry technique has been used for masses determinations of uranium-233 and plutonium-239, granted by AERE-HARWELL. A high purity Ge semicondutor detector was used and the total efficiency curve was obtained for the counting system in the energy range 13 KeV to 135 KeV. The calculated values for the masses compared with that obtained by means of gravimetry technique.

20146 **(LBL—26144) Transmission electron microscopy: Imaging of materials.** Thomas, G. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 33p. (CONF-880901—18). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007418/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

This report was an invited paper for a symposium and only covers general aspects of transmission electron microscopy. A history, and examples of work done on ceramics and alloys are covered. 6 refs., 44 figs. (JL)

20147 **(LRAP—80) Application of LIBS spectroscopy (Laser - Induced Breakdown Spectroscopy) for detection of gaseous species.** Agrup, S. (Lund Univ. (Sweden). Dept. of Physics). 1987. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757050/JAW.

The principle of LIBS is well known. A laser beam, when focused on a sample, creates a plasma consisting of electrons and exited and ionized atoms. When electric field of the laser radiation exceeds the dielectric strength of the sample, i.e. when the polarizing force is stronger than the atomic binding, dielectric breakdown occurs resulting in avalanche ionization and the creation of a plasma. During de-excitation energy is lost through bremsstrahlung emission, radiating transitions, electron recombination and by expanding chock waves. The LIBS method is based on analyzing the emitted UV and visible radiation. This can be done by integration in the time or with time or with time resolution. The latter variant is called Time REsolved Laser Induced Breakdown Spectroscopy (TRELIBS). Three different gases were examined: nitrogen, oxygen and sulphur dioxide. A characterization of these were made, i.e. some ionic, atomic and molecular transitions were identified and breakdown power threshold was determined. A small amount of oxygen was added to nitrogen in order to establish whether the signal strength is linear to the partial pressure and to find out what the detection limit would be. The measurements were repeated sulphur dioxide in nitrogen. The laser power dependence of the signal strength, the occurrence of the transition lines and the time history of the emitted lines were also investigated. Furthermore, examinations were made concerning the significance of the laser wavelength with respect to the above mentioned quantities.

20148 **(ORNL/CSD/TM—263) Safeguards Analytical Laboratory statistical analysis of wet chemistry quality control data.** Bayne, C.K. (Oak Ridge National Lab., TN (USA)). Mar 1989. Contract AC05-84OR21400. 86p. (ISPO—292). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007861/JAW.

This report examines quality control data for wet chemistry measurements made at Safeguards Analytical Laboratory (SAL), Seibersdorf, Austria. The statistical properties were evaluated for three data sets: (1) iron titer measurements, (2) percent bias factors for uranium titrations in the uranium laboratory, and (3) percent bias factors for both uranium and plutonium titrations in the plutonium laboratory. The statistical analysis of the iron titer data examined the effect of dodecane to reduce oxidation and the long-term oxidation rates. The statistical analysis of the bias factor data identified the major variance components and examined the behavior of their quality control charts. The sources of variation of the percent bias factors of uranium titrations were estimated for different (1) solutions of standard reference materials, (2) titrant solutions, (3) days, and (4) replicate measurements. Quality control charts for the percent bias factors for uranium and plutonium titrations were used to identify outlier values, procedural changes, and variance component sources. The identified problems were explained by the recorded notes in laboratory notebooks or by comments of laboratory personnel. The variance component analysis and the quality control charts showed that day-to-day variation of percent bias factors require daily determination of bias correction factors. 12 refs., 17 figs., 11 tabs.

20149 **(RCM—01588) Characterization of reference and site specific human acids. Interlaboratory comparison exercise of the 'COCO-club' in the CEC project MIRAGE II, part 1: Characterization.** Kim, J.I.; Buckau, G. (Technische Univ. Muenchen, Garching (Germany, F.R.). Lehrstuhl fuer Radiochemie). Jan 1988. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757159/JAW.

As a part of the interlaboratory exercise for the complexation of humic acid and colloid generation (COCO-Club activities) in the CEC project MIRAGE-II, the characterization of humic acids have been carried out, as for their elemental compositions, inorganic impurities, spectroscopic properties, size distributions and proton exchange capacities. The commercial humic acid (Na salt) from Aldrich Co. is purified to a protonated form and used as a reference material, and the humic acid extracted from one of Gorleben groundwaters is also purified to a protonated form and taken as a site specific material. These two humic acids, together with the original Na salt from Aldrich Co., are included for the characterization exercise. The results of characterization provide a basic knowledge that supports the forthcoming study of complexation of humic acids with actinides and fission products in their migration processes in the geosphere.

20150 **Supercritical fluid chromatography current status and prognosis.** Smith, R.D.; Wright, B.W.; Yonker, C.R. (Pacific Northwest Lab., Richland, WA (USA)). *Analytical Chemistry;* **60**: No. 23, 1323A-1336A(1 Dec 1988). Contract AC06-76RL01830.

In the 26 years since its inception, SFC has experienced rapid development. Richard D. Smith and co-workers at Pacific Northwest Laboratory describe the status of SFC, focusing on fundamental constraints caused by the solvating properties of supercritical fluids, and provide an outlook for the future.

20151 **Comparison between experimental and theoretical band profiles in nonlinear liquid chromatography with a pure mobile phase.** Golshan-Shirazi, S.; Ghodbane, S.; Guiochon, G. (Univ. of Tennessee, Knoxville (USA)). *Analytical Chemistry;* **60**: No. 23, 2630-2634(1 Dec 1988).

Experimental profiles have been obtained for large size samples of phenol in normal phase liquid chromatography on silica, using dichloromethane as mobile phase. These profiles are compared to the profiles predicted by the numerical integration of the equations of the theory of nonlinear chromatography. This requires the prior determination of accurate sorption isotherms of phenol between dichloromethane and silica. The agreement between the experimental and the theoretical profiles is quantitative in all cases.

20152 **Comparison between experimental and theoretical band profiles in nonlinear liquid chromatography with a binary mobile phase.** Golshan-Shirazi, S.; Guiochon, G. (Univ. of Tennessee, Knoxville (USA)). *Analytical Chemistry;* **60**: No. 23, 2634-2641(1 Dec 1988).

The experimental profiles obtained for large size samples in normal- and reversed-phase liquid chromatography are compared to the profiles predicted by the theory of nonlinear chromatography. When the sorption isotherms of the analytes are determined accurately, the agreement between the experimental and the theoretical profiles is quantitative in all cases. When the solvent is a mixture of a strong and a weak solvent, and if a nonselective detector is used, both the competitive adsorption isotherms of the analyte and the strong solvent should be taken into account. Then a two-component model of nonlinear chromatography must be used, and the system peaks are predicted. If a nonselective detector is used, however, which gives no response for the solvent (i.e., no system peak is detected), and the strong solvent is less strongly adsorbed than the solute studied, the elution profile of a large concentration band can be predicted with a one-compound model, knowing the adsorption isotherm of the solute from the solution. The conditions under which a single-component model can be used to predict with good or excellent agreement the profiles of large concentration bands of analyte eluted with a binary mobile phase are investigated.

20153 **Optimization of sensitivity and separation in capillary zone electrophoresis with indirect fluorescence detection.** Kuhr, W.G.; Yeung, E.S. (Iowa State Univ., Ames (USA)). *Analytical Chemistry;* **60**: No. 23, 2642-2646(1 Dec 1988). Contract W-7405-ENG-82.

Laser-induced indirect fluorescence detection can be used a general detector in capillary zone electrophoresis. Indirect fluorescence detection, where a fluorophore is used as the principal component of the electrophoretic buffer, allows the visualization of nonfluorescing ions through charge displacement of the fluorophore. Stabilization of laser power improves the dynamic reserve to 10^3 without the complication of double-beam correction techniques. A modification of the CZE power supply allows the use of dilute solutions and narrow bore capillary tubing (< 15 μm i.d.). The stability of the background fluorescence is improved by silylation of the fused silica capillary. These modifications improve the detection limits for many anions, nucleotides, and proteins to the range of 50-100 amol of sample injected. Additionally, this improvement in sensitivity results in a concomitant increase in separation efficiency. The electrophoretic separation can be optimized by calculating effective mobilities of ions based on their dissociation as a function of pH. More than 300,000 theoretical plates are observed in a separation of the nucleotide 5'-monophosphates optimized in this manner.

20154 **Shock effects in nonlinear chromatography.** Lin, B.; Golshan-Shirazi, S.; Ma, Z.; Guiochon, G. (Univ. of Tennessee, Knoxville (USA)). *Analytical Chemistry;* **60**: No. 23, 2647-2653(1 Dec 1988).

Shocks are discontinuities of a function that appear under certain sets of experimental conditions, such as a shock wave. This ideal concept has to be completed by the more realistic notion of shock layer. In a shock layer the function (pressure for a shock wave, concentration in chromatography) varies very steeply, and all the points in the shock layer (e.g., in a concentration profile) move at almost the same velocity as the shock itself would in the ideal case. In nonlinear, ideal chromatography, the behavior of elution band profiles starts to deviate markedly from what takes place in linear chromatography as soon as a concentration shock forms. Under the influence of the axial diffusions and the mass transfer kinetics the actual band profiles deviate from those predicted by the ideal model. The shocks are replaced by shock layers, but their positions and migration rates are modified only very slightly. The importance of these shocks on the shape and migration rate of the bands is dramatic. Classical concepts such as those of retention time, column efficiency, and resolution must therefore be analyzed within the framework of the shock theory.

20155 **Laminar-flow torch for helium inductively coupled plasma spectrometry.** Tan, H.; Chan, S.K.; Montaser, A. (George Washington Univ., Washington, DC (USA)). *Analytical Chemistry;* **60**: No. 22, 2542-2544(15 Nov 1988).

Helium inductively coupled plasmas (He ICPs) operated at atmospheric pressure, possess two advantages compared to Ar ICPs for atomic emission spectrometry (AES) and mass spectrometry (MS). First, for the elements tested so far, the detection powers for the He ICPs are superior to those for an Ar discharge. Second, the emission background spectra of the He ICPs are quite simple in the red and the near-infrared regions, thus reducing the spectral interference problems encountered with the determination of halogens and other nonmetals. Relatedly, certain mass spectral interferences noted in the detection of monoisotopic elements are eliminated when helium is used as the plasma gas instead of argon. For the most recent studies of He ICPs, the authors used a tangential-flow torch to form an annular plasma at forward power of 1500 W with a total helium gas flow of 8 L/min. The present study is concerned with the formation and preliminary characterization of a He ICP using a laminar-flow torch. The total helium gas flow for this torch is less than 2 L/min. Studies of plasmas formed in laminar-flow torches are important because of the possibility to reduce one major source of noise resulting from the rotation of the plasma gas in tangential-flow torches.

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REFER ALSO TO CITATION(S) 19192, 19300, 19304, 19452, 19480, 19813, 19947, 20026, 20105, 20114, 20127, 20130

20156 **(ANL/PPRNT—89-136) β-(BEDT-TTF)$_2$-AuCl$_4$: Importance of hydrogen--anion interactions in a descructive phase transition observed at low temperatures.** Geiser, U.; Wang, Hau H.; Anderson, B.A.; Williams, J.M.; Wangbo, Myung-Hwan. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38;FG05-86ER45259. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008393/JAW.

We report the synthesis of the first salt of the organic donor, bis-(ethylenedithio)tetrathiafulvalene (BEDT-TTF or simply ET), with a square-planar anion, AuCl$_4$/sup {minus}/, which leads to the 2:1 salt β-(ET)$_2$AuCl$_4$. The crystal structure analysis shows that the two-dimensional ET molecular network is comparable to that found in the ambient pressure superconductors β-(ET)$_2$X (X/sup {minus}/ = I$_3$/sup {minus}/, IBr$_2$/sup {minus}/, and AuI$_2$/sup {minus}/), with similar short interstack S{hor←ellipsis}S contacts of {approximately}3.60 {angstrom}. During our attempt to obtain low temperature x-ray diffraction data we discovered a destructive phase transition upon prolongated cooling to 130 K. The transition originates from extremely short hydrogen{hor←ellipsis}halogen contacts that occur when the conformation of an ethylene group of ET is frozen as the temperature is lowered. 21 refs., 5 figs., 5 tabs.

20157 **(ANL/PPRNT—89-162) Role of yttrium in enhanced adhesion of chromia scale to chromium.** Park, Jong-Hee. (Argonne National Lab., IL (USA)). Apr 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03 - OSTI. Order Number DE89008361/JAW.

The effects of small additions of yttrium on the interfacial adhesion of Cr/Cr$_2$O$_3$, Cr/Cr$_2$O$_3$-0.09 weight percent Y$_2$O$_3$, Cr-0.1Y/Cr$_2$O$_3$, and Cr-0.1Y/Cr$_2$O$_3$-0.09Y$_2$O$_3$ couples have been investigated at 1300{degree}C and a p/sub O{sub 2}/ value corresponding to Cr/Cr$_2$O$_3$ equilibrium. Results show that bonding occurs only in couples for which the Y is initially in the Cr. This observa-

tion suggests that the site of the reactive-element effect in scale adhesion during high-temperature oxidation is the metal substrate rather than the oxide scale. 8 refs., 4 figs.

20158 **(CONF-8808193—1) Calculation and characterization of reaction valleys for chemical reactions.** Dunning, T.H. Jr.; Harding, L.B.; Kraka, E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005863/JAW.

From NATO workshop on supercomputer algorithms for reactivity, dynamics and kinetics of small molecules; Villa Colombella, Italy (30 Aug 1988).

The calculation and characterization of molecular potential energy surfaces for polyatomic molecules poses a daunting challenge even in the Age of Supercomputers. We have written a program, STEEP, which computes reaction paths (IRCs) for chemical reactions and characterizes the reaction valley centered on the IRC. This approach requires that only a swath of the potential surface be determined, a computationally tractable problem even for many-atom systems. We report ab ignitio reaction paths/valleys for two abstraction reactions: the OH + H_2 reaction, which is a simple, direct process; and the H + HCO reaction which can proceed along two distinct pathways, a direct pathway and an addition-elimination pathway. We find that the reaction path/valley method provides many insights into the detailed dynamics of chemical reactions. 40 refs., 9 figs.

20159 **(CONF-8809117—2) Calculation of the energetics of chemical reactions.** Dunning, T.H. Jr.; Harding, L.B.; Shepard, R.L.; Harrison, R.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007262/JAW.

From 2. international symposium on computational chemistry on Cray supercomputers; Chicago, IL, USA (11 Sep 1988).

To calculate the energetics of chemical reactions we must solve the electronic Schroedinger equation for the molecular conformations of importance for the reactive encounter. Substantial changes occur in the electronic structure of a molecular system as the reaction progresses from reactants through the transition state to products. To describe these changes, our approach includes the following three elements: the use of multiconfiguration self-consistent field wave functions to provide a consistent zero-order description of the electronic structure of the reactants, transition state, and products; the use of configuration interaction techniques to describe electron correlation effects needed to provide quantitative predictions of the reaction energetics; and the use of large, optimized basis sets to provide the flexibility needed to describe the variations in the electronic distributions. With this approach we are able to study reactions involving as many as 5--6 atoms with errors of just a few kcal/mol in the predicted reaction energetics. Predictions to chemical accuracy, i.e., to 1 kcal/mol or less, are not yet feasible, although continuing improvements in both the theoretical methodology and computer technology suggest that this will soon be possible, at least for reactions involving small polyatomic species. 4 figs.

20160 **(CRN-CPR—88-04) Electron paramagnetic resonance of intrinsic point defects in GaAs following plastic deformation.** Benakki-Stiet, S. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1988. 148p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757194/JAW.

Defects generated in GaAs by a plastic deformation were studied to see if these defects, particularly anionic antisites associated with the deep donor EL2, were the same as those presented in the raw growth material, or the same as those which can be created in a high concentration by electron or neutron irradiation. Results show that there are different types of anionic antisites, so the subset associated with EL2 was identified. The apparent correlation between EL2 and dislocation density is discussed.

20161 **(DOE/ER/13263—5) Oligomer and mixed-metal compounds: Potential multielectron transfer agents: Progress report, July 1, 1988--February 28, 1989.** Rillema, D.P. (North Carolina Univ., Charlotte (USA). Dept. of Chemistry). 22 Feb 1989. Contract FG05-84ER13263. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008002/JAW.

We have made progress in synthesizing new ligands systems based on 2,2'-bipyridine. These new ligands have potential for designing square planar transition metal complexes and for providing photochemical stability to transition metal photocatalysts. A copper(II) derivative was synthesized and an x-ray structure was obtained to illustrate the coordination character of this new class of ligands. The following have also been synthesized and examined: multimetallic Ru(II), Re(I), Pt, Pd, and bispyridine complexes. 4 figs. (CBS)

20162 **(DOE/ER/13432—4) [Metallacumulenes and carbide complexes]: Progress report for year 1, May 1, 1988--April 30, 1989.** Selegue, J.P. (Kentucky Univ., Lexington (USA). Dept. of Chemistry). 25 Jan 1989. Contract FG05-85ER13432. 6p. NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89008004/JAW.

During this year, we worked mainly on three aspects of metallacumulene chemistry. Our long-term goal is to obtain a better understanding of the behavior of carbides and other carbon-rich fragments which result from transformations of carbon monoxide and acetylene on heterogeneous catalysts. Results of research on tungsten complexes, molybdenum complexes, ruthenium compounds, iron compounds, and cyanides are briefly discussed. (CBS)

20163 **(DOE/ER/13744—6) [Theory of the dissociation dynamics of small molecules on metal surfaces]: [Finite temperature studies] Technical progress report.** Jackson, B.E. (Massachusetts Univ., Amherst (USA). Dept. of Chemistry). [1989]. Contract FG02-87ER13744. 6p. NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89008255/JAW.

The primary goal of this study is to develop realistic theoretical models for the dissociative adsorption of diatomics on metals. We wish to treat the dissociating molecule as quantum mechanically as possible, and to properly include coupling to the thermal fluctuations of the solid. In these scattering techniques, the wave function of the molecule is written in an explicitly time dependent fashion. It is then evolved in time via the Schroedinger Equation, and scattered from or reacted with the surface. The final wave function is then used to compute all properties of interest. Progress has been made in studies of dissociation of H_2 on nickel, gas-surface energy transfer of He and Ne on Cu and Ni, and in the development of multi-dimensional models for dissociative adsorption. 15 refs.

20164 **(DOE/ER/40237—T5) Chemistry of gaseous lower valent actinide halides: Final report.** Hildenbrand, D.L.; Lau, K.H. (SRI International, Menlo Park, CA (USA)). Feb 1989. Contract AC03-85ER40237. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008462/JAW.

This report summarizes technical progress over a three-year period in a research program concerned with the chemistry of the gaseous lower valent actinide halides and related species. Reaction equilibrium studies were made by a combination of mass spectrometry and effusion pressure techniques, and enthalpy and entropy data were derived from the results. These studies covered various aspects of the U-Br, Th-F, Th-Cl, U-F, Th-Br, Ru-F, U-O-F, U-O-Cl, Th-O-Cl, and Np-F systems. Results are interpreted in terms of the bond dissociation energies, chemical bonding, molecular structure, and spectroscopic constants of these species. Many of the results have been reported in journal publications. 10 refs., 2 figs., 3 tabs.

20165 **(IC—88/337) Ultrasonic speed as a guide of the concentration of alkali-halides ions in water.** Hanna, M.H.; Luqman, M.K.; Hussain, M.S. (International Centre for Theoretical Physics, Trieste (Italy); Salahuddin, Univ., Arbil (Iraq). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705987/JAW.

The speed of an ultrasonic wave has been examined in many alkali-halides water solutions at 35 deg. C and different concentrations. The speed seems to be subject to substantial changes with changing the mass of the negative ions rather than the positive ions. The results indicate that the negative ion masses affect the water bulk modulus in a nonlinear way and each mass has its own characteristic effects. (author). 7 refs, 4 figs, 1 tab.

20166 **(ICEFIZ-LOP—64-1988) IR laser photochemistry.** Ursu, I.; Alexandrescu, R.; Morjan, I.; Mihailescu, I.N.; Draganescu, V.; Jianu, V.; Popescu, C. (Institutul de Fizica si Tehnologia Aparatelor cu Radiatii, Bucharest (Romania); CCSITR-Intreprinderea chimica Dudesti-ICECHIM, Bucuresti, Romania; Centrul de cercetari pentru materii prime, auxiliare si ape reziduale, Bucuresti, Romania). (Central Inst. of Physics, Bucharest (Romania)). Mar 1988. 18p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706012/JAW.

The work presents our results obtained in the field of IR laser photochemistry in order to obtain chemical products of high purity and of economical importance. (authors).

20167 (INIS-BR—1439, pp 17) **Consideration on spectrum of perchlorate complexes of Nd/sup 3+/ and Eu/sup 3+/ with pyrazine 1,4- dioxide (pyzDO).** Oliveira, M.A.S. de; Vicentini, G. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil); Sao Paulo Univ., SP (Brazil). Inst. de Quimica). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20168 (INIS-BR—1439, pp 60) **Preparation and physical-chemical characterizations of Zeolite ZSM-5 modified by phosphorous.** Ramos, R.M.S.; Cruz, G.M. da. (Instituto Nacional de Tecnologia, Rio de Janeiro, RJ (Brazil); Instituto Militar de Engenharia, Rio de Janeiro, RJ (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20169 (INIS-BR—1439, pp 16) **Comparative study between methanesulfonates (Ms) of rare earths and aromatic aminoxides.** Zinner, L.B.; Matos, J.R. (Sao Paulo Univ., SP (Brazil). Inst. de Quimica). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20170 (INIS-BR—1439, pp 19) **Synthesis and characterization of addition compounds between lanthanide perchlorates and δ-valerolactam.** Carvalho, L.R.F. de; Vicentini, G. (Sao Paulo Univ., SP (Brazil). Inst. de Quimica). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20171 (INIS-BR—1439, pp 99) **Determination of residence time of an acid in a tubular reactor.** Onzi, M.A.; Ritter, M.I. 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

20172 **(INIS-mf—11370) Synthesis of ring-/sup 13/C-labelled and ring-demethylated retinals. Investigations on /sup 13/C-labelled and chemically modified (bacterio)rhodopsins.** Courtin, J.M.L. (Rijksuniversiteit Leiden (Netherlands)). 13 Jan 1988. 167p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706068/JAW.

Includes Dutch summary.

Efficient synthetic schemes are described for the preparation of the required mono- and di-/sup 13/C labelled retinals based on simple /sup 13/C labelled starting materials. Results from solid-state /sup 13/C-NMR spectroscopic studies of the various ring-/sup 13/C labelled bacteriorhodopsins and rhodopsins are discussed. 404 refs.; 74 figs.; 16 tabs.

20173 **(IPEN-PUB—201) Thermoluminescent system for low temperatures.** Rosa, L.A.R. da; Caldas, L.V.E.; Leite, N.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Sep 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705546/JAW.

A system for measurements of the thermoluminescent glow curve, the thermoluminescent emission spectrum and the optical absorption spectrum of solid samples, from liquid nitrogen temperature up to 473 K, is reported. A specially designed temperature programmer provides a linear heating of the sample at a wide range of selectable heating rates, as also long term steady-state temperatures for annealing and isothermal decay studies. The system operates at a pressure of 1.33 x 10/sup -3/Pa. Presently it is being used for lithium fluoride low temperature thermoluminescent studies.

20174 **(IS-T—1366) Reactions of sulfur dioxide with pentaaquoorganochromium(III) complexes and trispolypyridinechromium(II) complexes.** Simmons, C.A. (Ames Lab., IA (USA)). Jul 1988. Contract W-7405-ENG-82. 195p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007625/JAW.

Chapter I describes the kinetics and mechanism of the reaction between sulfur dioxide and $(H_2O)_5CrR^{2+}$ complexes. Parallels between this reaction and other electrophilic reactions of the $(H_2O)_5CrR^{2+}$ complexes are drawn. The occurrence of two types of inorganic products is explained. Chapter II describes the production of $^*Cr(NN)_3^{3+}$ via photochemical methods, the reductive quenching of it by $Co([14]aneN_4)^{2+}$ to form $Cr(NN)_3^{2+}$, and the electron transfer reactions of $Cr(NN)_3^{2+}$ with SO_2 and $Co([14]aneN_4)^{3+}$. The self-exchange rate constant of the SO_2/SO_2/sup {minus}/ couple is extracted by the use of Marcus Theory. 41 refs., 15 figs., 6 tabs.

20175 **(LBL—23799) Classification of catalytic reactions based on molecular surface science.** Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1987. Contract AC03-76SF00098. 53p. (CONF-8706375—1). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006601/JAW.

From Boreskov memorial conference; Novosibirsk, USSR (21 Jun 1987).

The surface science studies of catalytic reactions which have been performed to date indicate that there are three types of metal-based catalytic systems: (1) the first encompasses reactions that occur directly on a bare metal surface; (2) the second class includes reactions occurring on an overlayer that is irreversibly bound to the metal surface; and (3) reactions on coadsorbate modified surfaces fall into the third category. These catalysts contain additives that alter the bonding of reactants to the surface, or block specific reaction sites, altering reaction pathways. The following accounts present case histories of surface science studies of catalytic processes representing each of the three categories. We shall discuss ways in which these reaction types may be identified by experiments. Finally, some of the methods that could be employed to build catalysts with desirable properties will be reviewed. 90 refs., 20 figs., 2 tabs.

20176 **(LBL—26577) Irreversible adsorption of phenolic compounds by activated carbons.** Grant, T.M.; King, C.J. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 251p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008386/JAW.

Studies were undertaken to determine the reasons why phenolic sorbates can be difficult to remove and recover from activated carbons. The chemical properties of the sorbate and the adsorbent surface, and the influences of changes in the adsorption and desorption conditions were investigated. Comparison of isotherms established after different contact times or at different temperatures indicated that phenolic compounds react on carbon surfaces. The reaction rate is a strong function of temperature. Regeneration of carbons by leaching with acetone recovered at least as much phenol as did regeneration with other solvents or with displacers. The physiochemical properties of adsorbents influences irreversible uptakes. Sorbates differed markedly in their tendencies to undergo irreversible adsorption. 64 refs., 47 figs., 32 tabs.

20177 **(LBL—26680) Organolanthanide reagents and the Mukaiyama reaction.** Gong, L. (Lawrence Berkeley Lab., CA (USA)). Jan 1989. Contract AC03-76SF00098. 161p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008166/JAW.

The bis(pentamethylcyclopentadienyl) lutetium halide complex $[(C_5Me_5)_2LuCl\{center\leftarrow dot\}THF]$ was synthesized and characterized. The crystal structure of this complex shows that the Lu is at the center of a distorted tetrahedron consisting of the centroids of two cyclopentadienyl rings, the oxygen atom of a tetrahydrofuran molecule and a chlorine atom. ^1H NMR studies of toluene-d_8 solutions of $(C_5Me_5LuCl(THF) + THF$, $(TMS_2CP)_2LuCl(THF) + THF$, and $(MeCp)_2LuCl(THF) + THF$ at various temperatures showed exchange processes between co- ordinated THF and free THF with average values of $\Delta G/sup\ ne/$ of 13.0 {+-} 0.3 kcal/mol, 11.1 {+-} 0.1 kcal/mol and <11 kcal/mol at 0{degree}C, respectively. It has been found that under the influence of a catalytic amount (1–5 mol %) of $(TMS_2Cp)_2YbCl$ dimer, silyl enol ethers $(R_1R_2C = C(OR_3)OSiMe_3)$ react with benzaldehyde smoothly in dichloromethane at room temperature, giving >99% of the aldol silyl ether (isolated yield: 90%) within 3 h. At {minus}78{degrees} C, the reaction gives kinetically controlled diastereoselectivity, which was not observed in the $TiCl_4$-mediated aldol reaction. The use of organoytterbium enolates shows promise result with respect to increased stereoselectivity, and indicates the importance of the bulky ligands on the metal center. In addition, Yb(III) species can retard retroaldol reaction owing to its mild Lewis acidity. 118 refs., 14 figs., 30 tabs.

20178 **(LBL—26690) Spectroscopy and reaction kinetics of HCO.** Guo, Yili. (Lawrence Berkeley Lab., CA (USA)). Jan 1989. Contract AC03-76SF00098. 175p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008487/JAW.

The high-resolution infrared spectrum of the C-H stretching fundamental of HCO has been studied by means of infrared flash kinetic spectroscopy. HCO was generated by flash photolysis of acetaldehyde or formaldehyde using a 308 nm (XeCl) excimer laser. The transient absorption was probed with an infrared difference frequency laser system. The high resolution spectra obtained were assigned and fitted with rotational, spin-rotational, and centrifugal distortion constants. The ν_1 band origin is 2434.48 cm/sup {minus}1/. New ground state constants have been derived from a least-squares fit combining the ν_1 data with previous microwave and FIR LMR measurements. A new set of spectroscopic constants for the (1, 0, 0) state, the equilibrium rotational constants, and the orientation of the transition dipole moment are also reported. The kinetics and product branching ratios of the $HCO + NO_2$ reaction have been studied using visible and infrared laser flash kinetic spectroscopy. The rate constant for the disappearance of HCO radical at 296 K is (5.7 +- 0.9) {times} 10/sup {minus}11/ cm^3 molec/sup {minus}1/ sec/sup {minus}1/, and it is independent of the pressure of SF_6 buffer gas up to 700 torr. Less than 10% of the reaction goes through the most exothermic product channel, $HNO + CO_2$. The product channel, $H + CO_2 + NO$, is responsible for 52% of the reaction. HONO has been observed, though not quantitatively, as a reaction product corresponding to the HONO + CO channel. 51 refs., 21 figs., 8 tabs.

20179 **(PSI—24) On the coordination chemistry of humic materials.** Grauer, R. (Paul Scherrer Institut, Villigen (Switzerland)). (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Jan 1989. 109p. (In German). NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706124/JAW.

Dissolved humic materials form ligands which can influence the speciation of certain radionuclides in natural waters and it is necessary to take account of this phenomenon in repository safety assessment model calculations. There are no models available which give a basic description of the wide range of complexation properties of humic materials with dissolved metals and which are based on a chemically meaningful background. All of these models make very drastic simplifications and, although capable of reproducing experimental data, they do not allow any extrapolation to ranges of concentration outside those covered by the experiments. Humic materials affect not only the solution chemistry of the metals but also their sorption onto minerals. The mineral surfaces are modified through adsorption of organic material which in turn alters their sorption properties. These processes are understood in qualitative terms. It is unlikely that a comprehensive predictive model of complexation by humic materials will be available in the foreseeable future. It is therefore suggested that experiments which provide an empirical description of the metal/humic material interaction using realistic pH values and metal/ligand ratios be carried out. Besides parameter studies and experiments in synthetic or formation waters, analogue studies could also serve as a useful tool. 132 refs., 51 figs., 12 tabs.

20180 **Reaction-path analysis of the effect of monomer excitation on the tunneling splitting of the hydrogen fluoride dimer.** Hancock, G.C.; Truhlar, D.G. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **90**: No. 7, 3498-3505(1 Apr 1989).

The tunneling splitting of $(HF)_2$ has been calculated by semiclassical adiabatic reaction-path methods, employing a small-curvature approximation for the effective mass along the tunneling path. The calculations include all six vibrational degrees of freedom and are based on the partly ab initio, partly semiempirical potential energy surface proposed recently by the authors and Dykstra. The calculations are carried out for both unexcited and excited monomer vibrations, and they correctly predict that excitation of either monomer lowers the tunneling splitting, but they do not explain why the lower-energy monomer stretch is equally as effective as the higher-energy one.

20181 **Quantum reactive scattering in three dimensions using hyperspherical (APH) coordinates. III. Small θ behavior and corrigenda.** Pack, R.T.; Parker, G.A. (Theoretical Division (T-12, MS J569), Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **90**: No. 7, 3511-3519(1 Apr 1989).

We continue development of the theory of reactive (rearrangement) scattering using adiabatically adjusting, principal axis, hyperspherical (APH) coordinates. The behavior of the solutions for small θ (oblate symmetric top) configurations is examined, and it is shown that the exact surface functions need not be continuous at $\theta = 0$. A procedure for testing the importance of the small θ region and the adequacy of the usual APH centrifugal sudden basis of surface functions is presented and illustrated by example calculations on the even parity, $J = 1$, H_3 system. A list of corrections to earlier papers in the series is also given.

20182 **Three dimensional reactive scattering study of the photodetachment spectrum of $ClHCl^-$.** Schatz, G.C. (Theoretical Chemistry Group, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **90**: No. 7, 3582-3589(1 Apr 1989).

In this paper, the photodetachment spectrum of $ClHCl^-$ is simulated theoretically by calculating the Franck—Condon overlap between the negative ion ground state vibration/rotation wave function, and a ClHCl scattering wave function that is determined accurately using a three dimensional hyperspherical reactive scattering method. The resulting spectrum shows a broad low energy

peak that is due to direct scattering, and a narrow higher energy peak that is mainly due to a resonance associated with the transition state region of the Cl + HCl reaction. These two peaks are in good agreement in position and relative intensity with a spectrum recently measured by Neumark and co-workers.

20183 **Direct correlations of the capillary wave model and construction of the free energy density functional for the liquid—vapor interface system.** Percus, J.K.; Zhang, M.Q. (Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, N.Y. 10012). *Journal of Chemical Physics;* **90**: No. 7, 3795-3799(1 Apr 1989).

We use the capillary wave model of a liquid—vapor interface as a working example to show how to construct the free energy density functional from studies of the direct correlation functions of a reference system, and vise versa.

20184 **High-resolution electron-energy-loss spectroscopy study of the uv-laser photodissociation of adsorbed $Al_2(CH_3)_6$ on Si(100)21 and Si(111)77 surfaces.** Lubben, D.; Motooka, T.; Greene, J.E.; Wendelken, J.F. (Department of Materials Science, The Coordinated Science Laboratory and The Materials Research Laboratory, 1101 West Springfield Avenue, University of Illinois, Urbana, Illinois 61801). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 8, 5245-5253(15 Mar 1989).

High-resolution electron-energy-loss spectroscopy (HREELS) has been used to study the adsorption and uv-laser-induced dissociation of $Al_2(CH_3)_6$ [trimethylaluminum (TMA)] on Si(100)2 x 1 and Si(111)7 x 7 surfaces. Single-layer adsorption was obtained for substrate temperatures T/sub s/ between 180 and 200 K, while multilayer deposition occurred for T/sub s/<180 K. Low-energy electron diffraction patterns showed no evidence of long-range order in either the single-layer or multilayer deposits. HREELS spectra from TMA single layers adsorbed on Si(100)2 x 1 and Si(111)7 x 7 were consistent with those expected for nondissociatively adsorbed TMA dimers whose Al-Al axes are orthogonal to the substrate surface. No changes in the adlayer spectra were observed under KrF-laser irradiation (248 nm, 5.0 eV, 20-ns pulses) even after 10^4 pulses with intensities up to 200 mJcm/sup -2/ per pulse. Low-intensity (20mJcm/sup -2/) ArF-laser irradiation (193 nm, 6.4 eV, 20-ns pulses), however, led to monomerization of the adsorbate. Higher-intensity (200 mJ cm/sup -2/) ArF-laser irradiation caused dissociation of the TMA monomer and desorption of some methyl ligands. Both KrF- and ArF-laser irradiation of multilayer samples gave rise to immediate thermally induced desorption of loosely bound upper layers, while the remaining adlayer behaved in a manner similar to that of the single-layer samples.

20185 **Universality in interacting membranes: The effect of cosurfactants on the interfacial rigidity.** Safinya, C.R.; Sirota, E.B.; Roux, D.; Smith, G.S. (Exxon Research and Engineering Company, Annandale, New Jersey 08801). *Physical Review Letters;* **62**: No. 10, 1134-1137(6 Mar 1989).

We report on synchrotron x-ray scattering studies of multimembrane systems in the fluid L/sub α/ phase. By embedding cosurfactant molecules in a model biological membrane (di-myristoylphosphoridyl-choline) system, we dramatically reduce the bending rigidity of the fluid bilayer. This effect leads to a crossover from a microscopically driven to a fluctuation-induced universal regime for intermembrane interactions. Studies of a homologous cosurfactant series, with varying hydrocarbon chain length between 5 and 12, allow us to attribute this reduction in k/sub c/ to the thinning of the membrane.

20186 **Aggregation in colloidal gold.** Wilcoxon, J.P.; Martin, J.E.; Schaefer, D.W. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2675-2688(1 Mar 1989).

Static and dynamic light scattering are used to study the aggregation kinetics and structure of colloidal gold. Fast aggregation is achieved by either addition of pyridine, lowering of the pH, or addition of salt. The kinetics of rapid growth is followed by measurement of the polarized relaxation time tau/sub v//sub v/ (proportional to the mean cluster radius). We observe a power law, tau/sub v//sub v/proportional(Ct)/sup x/, with x = 0.38 +- 0.04, where t is the time and C is the initial sol concentration. Measurements of the depolarized relaxation time tau/sub v//sub h/ as Q→0 (Q is the wave vector) are found to be proportional to the third power of the cluster radius, typical of rotational diffusion. Such measurements allow independent confirmation of the kinetics as tau/sub v//sub h/ = (Ct)/sup 3x/, with x = 0.38 +- 0.04. The static light scattering intensity I from these rapidly grown clusters obeys a power law, IproportionalQ⁻/sup y/ with y = 1.74 +- 0.1, at a wavelength of λ = 633 nm (optical resonance is 680 nm), with the value of y increasing away from resonance to a value of 2.0 +- 0.1 at λ = 457 nm. Under diluted conditions the scattering behavior is identical on and off resonance with y = 2.0 +- 0.1.

20187 **Resonant isotopic depletion spectroscopy.** Janik, G.R.; Bushaw, B.A.; Cannon, B. (Pacific Northwest Laboratory, P.O. Box 999, K3-57, Richland, Washington 99352). *Optics Letters;* **14**: No. 5, 266-268(1 Mar 1989).

We have devised a simple new scheme to increase the isotopic selectivity in optical rare-isotope detection experiments. We can effectively remove interfering isotopes from an atomic beam by optically pumping them into a state that is invisible to the optical detection system. The selectivity of this resonant depletion scales exponentially with the isotope shift and yields almost unlimited selectivity in principle. We have demonstrated a selectivity of 6 x 10^5 with a single laser excitation in a beam of metastable krypton atoms. With better laser stability we may be able to improve the selectivity much further.

20188 **Effects of high atom densities on the NMR relaxation times in solid T_2 and DT.** Gaines, J.R.; Souers, P.C.; Fearon, E.M.; Sater, J.D.; Mapoles, E.R. (Department of Physics, University of Hawaii, Honolulu, Hawaii 96822). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 3943-3953(1 Mar 1989).

Experimental NMR data on solid T_2 and DT are used to study the effects of high-atom densities on the transverse and longitudinal relaxation times. Data for the second moments, the self-diffusion coefficient, and T_1 are analyzed and compared to similar measurements in H_2, D_2, and HD in order to isolate the contributions to these quantities due to atoms. Subtle effects are seen on the second moments but no direct effect is seen on the value of T_1 even for atom densities of order 10/sup 20/ cm/sup -3/.

20189 **Rate Constants for the Quenching of Excited States of Metal Complexes in Fluid Solution.** Hoffman, M.Z.; Bolletta, F.; Moggi, L.; Hug, G.L. (Department of Chemistry, Boston University, Boston, Massachusetts 02215). *Journal of Physical and Chemical Reference Data;* **18**: No. 1, 219-543(Jan 1989).

The rate constants for the quenching of the excited states of metal ions and complexes in homogeneous fluid solution are reported in this compilation. Values of k/sub q/ for dynamic, collisional processes between excited species and quenchers have been critically evaluated, and are presented with the following information, among others, from the original publications, when available: description of the solution medium, temperature at which k/sub q/ was determined, experimental method, range of quencher concentration used, lifetime of the excited state in the absence of quencher, activation parameters, quenching mechanism. Data collection is complete through the end of 1986, and covers the coordination compounds of 26 metals, including the ions and complexes of the inner- and outer-transition metals, and porphyrin complexes of nontransition metals. Data for 261 excited states quenched by more than 400 inorganic quenchers and 600 organic quenchers have been extracted from almost 500 publications. The introduction to the work contains a discussion of the conceptual background to quenching, including a general treatment of the kinetics, an explanation of the tables, and a list of recent review articles. Uncommon kinetics mechanisms and equations, used to obtain the reported values of k/sub q/, are discussed in detail as part of the notes to the tables. Indexes of excited states, quenchers, and authors are appended.

20190 **Characterization of temperature correction method for kinetic methods of analysis with the extended Kalman filter.** Corcoran, C.A.; Rutan, S.C. (Virginia Commonwealth Univ., Richland, WA (USA)). *Analytical Chemistry;* **60**: No. 22, 2450-2454(15 Nov 1988). Contract FG05-88ER13833.

An extended Kalman filter for compensating for within-run temperature variations in kinetic methods of analysis is critically evaluated with first-order synthetic data. The kinetic data represent values ranging from 0.7 to 14 half-lives and include a random noise contribution to give approximate signal-to-noise ratios of 100, 1000, and 10,000. The theoretical and experimental performances of the method are compared by evaluating the data with three data analysis programs based on the extended Kalman filter algorithm. The effects of variations in temperature data morphologies are also considered. Criteria for selection of an appropriate data analysis method are presented, based on the results obtained in the comparative study.

20191 **Molten salt extraction process for the recovery of valued transition metals from land-based and deep-sea minerals.** Maroni, V.A.; VonWinbush, S. (to Dept. of Energy, Washington, DC). US Patent 4,762,694. 9 Aug 1988. Filed date 21 Aug 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a process for recovering at least three transition metals from an ore by direct dissolution of the ore in a molten salt comprising the steps of combining the ore with the molten salt containing mixed alkali or alkaline earth metal chlorides or mixtures thereof to dissolve the transition metals as chlorides in the molten salt, the salt being at a temperature of not more than 500°C., removing at least one transition metal chloride from the molten salt by distillation at a temperature below about 500°C, electrolytically recovering at least a second transition metal from the molten salt at a voltage with respect to Ag/AgCl that is not more negative than about -1.5 volts, and treating the remaining molten salt with a source of oxygen to precipitate an oxide of at least a third transition metal.

20192 **A mechanistic study of the interaction of ultraviolet laser radiation with low density polymers.** Hargis, P.J. Jr. (Sandia National Labs., Albuquerque, NM (US)). pp v of Photon, beam, and plasma stimulated chemical processes at surfaces. Donnelly, V.M.; Herman, I.P.; Hirose, M. Pittsburgh, PA; Materials Research Society (1987). (CONF-8612130—).

From Materials Research Society symposium on photon, beam and plasma stimulated chemical processes at surfaces; Boston, MA, USA (1 Dec 1986).

Ultraviolet laser radiation at 248 nm and 266 nm was used to ablate low density (0.04 to 0.14 g/cm/sup 3/) microcellular polystyrene and TPX foams at laser fluences between 0.1 and 1000 J/cm/sup 2/. The dependence of the etch rate on laser fluence and foam density is consistent with a linear absorption mechanism for the initial stages of polystyrene ablation. Studies of the morphology and chemical composition of the ablated foams as a function of laser fluence and foam density show that the degree of melting increases at the higher forma densities. Blackbody and radical specie contributions to optical emission from the ablated foam were readily resolved for correlation with laser fluence, foam density, absorption spectra, and etch depth. Temperatures in excess of 3000°K are calculated from emission spectra observed during the ablation of polystyrene foams. From this data the authors conclude that chemical and thermal changes in the ablated foam are influenced by the absorption spectrum as well as the density of the foam.

20193 **Organic chemistry in ambient temperature chloroaluminate melts. I. Protonation of arenes.** Dworkin, A.S.; Smith, G.P.; ZIngg, S.P.; Pagni, R.M. (Oak Ridge National Lab., P.O. Box X, Bldg. 4500S, Oak Ridge, TN (US)). pp v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. Pennington, NJ; The Electrochemical Society (1987). (CONF-871027—).

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

Acidic chloroaluminates are the quintessential Friedel-Crafts catalysts. Many of the reactions that they activate are of the carbenium-ion-chain type. In the case of arene (ArH) substrates a key step is the partial protonation of ArH by a protic acid (HB) as shown in Eq. 1 , where B- is a generic base and ArH/sub 2//sup +/ is the protonated arene or arenium ion. The apparent role of the acidic chloroaluminate is the ArH + HB $\rightleftharpoons$ ArH/sub 2//sup +/ + B/sup -/. Enhancement of the protonating strength of HB through the reaction of acidic chloroaluminate species, such as Al/sub 2/Cl/sub 6/, Al/sub 3/Cl/sub 7/- or Al/sub 3/Cl/sub 10-/., with the base B/sub -/. The simplest example of HB is HCl for which the overall protonating reaction is given in Eq. 2, where ArH + HCl + Al/sub 2/Cl/sub 7/- $\rightleftharpoons$ ArH/sub 2/+ + 2AlCl/sub 4/- Al/sub 2/Cl/sub 7/- represents the acidic chloroalmuniate.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 19971, 20040

20194 **(DOE/ER/45273—3) [Monitoring interfacial dynamics by pulsed laser techniques]: Progress report for year 3, August 1, 1988--December 1, 1988.** Richmond, G.L. (Oregon Univ., Eugene (USA)). 1988. Contract FG06-86ER45273. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008218/JAW.

Our efforts have been directed in three areas. The first has involved performing time resolved second harmonic generation experiments on the charging and discharging of the double layer at the silver/aqueous electrolyte system as a means of checking the validity of theoretical models proposed to describe the dc dependent SH response at this interface. Secondly, we have continued our experiments on the kinetics of deposition and stripping of thin metallic overlayers on metal surfaces. Thirdly, we have completed our construction of a photothermal deflection spectrometer to measure weak absorptivities of various photoactive semiconductors. An example is given for $MoSe_2$. 1 fig.

4005 Photochemistry

REFER ALSO TO CITATION(S) 19865, 20055, 20184, 20666

20195 **(ANL/PPRNT—89-180) The reactions of neutral iron clusters with D_2O: Deconvolution of equilibrium constants from multiphoton processes.** Weiller, B.H.; Bechthold, P.S.; Parks, E.K.; Pobo, L.G.; Riley, S.J. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008364/JAW.

The chemical reactions of neutral iron clusters with D_2O are studied in a continuous flow tube reactor by molecular beam sampling and time-of-flight mass spectrometry with laser photoionization. Product distributions are invariant to a four-fold change in reaction time demonstrating that equilibrium is attained between free and adsorbed D_2O. The observed negative temperature dependence is consistent with an exothermic, molecular addition reaction at equilibrium. Under our experimental conditions, there is significant photodesorption of D_2O (Fe/sub n/(D_2O)/sub m/ + hν $\rightarrow$ Fe/sub n/ + m D_2O) along with ionization due to absorption of multiple photons from the ionizing laser. Using a simple model based on a rate equation analysis, we are able to quantitatively deconvolute this desorption process from the equilibrium constants. 8 refs., 1 fig.

20196 **(CONF-8808200—1) Bonding and structure in the hydrides of Groups III-VI deduced from photoionization studies.** Berkowitz, J.; Ruscic, B.; Gibson, S.T.; Cho, H.; Mayhew, C.A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007505/JAW.

From International symposium on the electronic structure and properties of molecules and crystals; Zagreb, Yugoslavia (29 Aug 1988).

We present an overview of recent photoionization studies of transient hydride species of Group III-VI, and the conclusions drawn from these studies. The transient species investigated include BH_3, C_2H_3, SiH/sub n/ (n = 1 {minus} 3) PnH/sub n/ (Pn = N, P, As; n = 1,2), and ChH (Ch = O, S, Se). Photodissociative ioni-

zation of certain stable species, e.g. B_2H_6, SiH_4, PnH_3 and ChH_2 inevitably become part of the investigation. From the various dissociative and adiabatic ionization thresholds, we determine a variety of useful thermochemical data, which either help to resolve controversies or provide new experimental information. These include (a) the dimerization energy of borane; (b) the C-H bond energy in ethylene; (c) the incremental bond energies in SiH/sub n/, PnH/sub n/ and ChH/sub n/; and (d) the $^3B_1$ - $^1A_1$ splitting in SiH_2, NH_2^+, PH_2^+ and AsH_2^+. These results provide experimental tests of recent ab initio calculations. They also reveal the limitations of the semi-empirical Goddard-Harding model for PnH/sub n/ and ChH/sub n/. 16 refs., 6 figs., 2 tabs.

20197 **(DOE/ER/13937—1) [Laser enhanced chemical reactions]: [Progress report].** Flynn, G.W. (Columbia Univ., New York (USA)). [1989]. Contract FG02-88ER13937. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008084/JAW.

This report contains information on the following topics: the diode laser probe techniques; hot atoms excitation of vibrational states of polyatomic molecules, and biomolecular quenching and reactions of $O(^1D)$. 34 refs. (LSP)

20198 **(IS-T—1383) Ultrafast pump-probe spectroscopy of electronic excitation transfer in random molecular systems and in photosynthetic antennae.** Causgrove, T.P. (Ames Lab., IA (USA)). Feb 1989. Contract W-7405-ENG-82. 262p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007677/JAW.

Optical pump-probe (transient absorption) spectroscopy was used to study excitation energy transfer (EET) in random molecular systems and in antenna complexes of photosynthetic organisms. Energy transfer was first studied for Rhodamine 640 adsorbed on ZnO and fused silica surfaces at submonolayer coverage. Also, EET experiments were performed on solutions of Rhodamine 640 in glycerol using both absorption depolarization and the well-known technique of fluorescence depolarization using time-correlated single photon counting. Data from both techniques match within experimental error theoretical predictions, showing the validity of pump-probe techniques in studying EET. The absorption depolarization of the Q/sub x/ electronic transitions in BChl a-protein from P. aestuarii was monitored, and the anisotropy was found to decay to a constant, nonzero value due to nonrandom chromophore orientations. The timescale of depolarization was found to be consistent with transfer between delocalized exciton states. Results of experiments on the core antenna complex of photosystem I were remarkably similar. 279 refs., 52 figs., 9 tabs.

20199 (N—89-14503, pp 98-100) **Mass accommodation coefficient measurements for HNO_3, HCl and N_2O_5 on water, ice and aqueous sulfuric acid droplet surfaces.** Worsnop, D.; Zahniser, M.; Kolb, C.; Watson, L.; Vandoren, J.; Jayne, J.; Davidovits, P. (Boston Coll., Chestnut Hill, MA (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Preliminary results are reported of the direct measurement of accommodation coefficients for HNO3, N2O5 and HCl on water drops, aqueous sulfuric acid drops and ice particles. The heterogeneous chemistry of these species together with ClONO2 has been implicated in the ozone depletion observed in the Antarctic stratosphere during the spring in the last eight years. The most plausible chemical mechanism involves the removal of nitrogen oxide species via condensation on ice particles in polar stratospheric clouds resulting in a increase in the active chlorine species responsible for the ozone depletion. The observation of low NO2 and high ClO densities in the Antarctic stratosphere last summer appear to be consistent with such a mechanism.

20200 **Photodissociation of formaldehyde: A coupled cluster study including connected triple excitations of the transition state barrier height for $H_2CO \rightarrow H_2 + CO$.** Scuseria, G.E.; Schaefer H.F. III. (Center for Computational Quantum Chemistry, School of Chemical Sciences, University of Georgia, Athens, Georgia 30602). *Journal of Chemical Physics;* **90**: No. 7, 3629-3636(1 Apr 1989).

Ab initio molecular quantum mechanics has been applied to the unimolecular dissociation of H_2CO. Basis sets as large as triple zeta plus double polarization (TZ+2P) were used in conjunction with complete optimization of all stationary point geometries. The classical barrier height is predicted with the TZ+2P basis set to be 101.9 (SCF), 95.0 (CISD), 90.4 (CCSD), and 86.8 kcal/mol (CCSDT-1). With correction for zero-point vibrational energies, the activation energy is predicted to be 81.4 kcal/mol, in good agreement with experimental estimates.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 19971, 20714

20201 (INIS-mf—11356, pp 209) **Effect of gamma irradiation on the formation of cholesterol oxidation products in meat.** Zabielski, J. (Univ. of Agriculture of Poznan, Poznan (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20202 (INIS-mf—11356, pp 40) **Dependence of the retrogradiation degree of gamma /sup 60/Co irradiated triticale starches in their physico-chemical properties.** Bachman, S.; Witkowski, S.; Nowotny, A.; Gambus, I. (Technical Univ. of Lodz, Institute of Applied Radiation Chemistry, Laboratory of Food Irradiation, Lodz (Poland); Agricultural Academy, Institute of Carbohydrate Technology, Krakow (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 19428, 19638, 19865, 20197, 20651, 20660, 20661

20203 **(ANL/PPRNT—89-182) A kinetic study of the complexation reaction between the dioxouranium(VI) ion and Arsenazo III.** Pippin, C.G.; Sullivan, J.C. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008362/JAW.

The rates of formation of the 1:1 complexes between the aquo UO_2^{2+} ion and Arsenazo III were determined in 2.0 M perchloric acid solutions. The kinetic data are consistent with a first-order approach to equilibrium due to the concentration conditions under which the reaction was studied. 14 refs., 2 tabs.

20204 **(INIS-BR—1421) Effect of the size of the vase on determination of isotopic exchangeable phosphorous (L value).** Minasse, H.M.; Muraoka, T.; Rossetto, R.; Salvador, J.O. (Sao Paulo Univ., Piracicaba, SP (Brazil). Escola Superior de Agricultura Luiz de Queiroz; Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil)). (Taubate Univ., SP (Brazil). Dept. de Agronomia). 1984. 1p. (In Portuguese). (CONF-8409415—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705744/JAW.

From 4. Brazilian congress on agronomics scientific introduction; Taubate, Brazil (11 Sep 1984).

20205 **(LBL—26762) Molecular beam studies of hot atom chemical reactions: Reactive scattering of energetic deuterium atoms.** Continetti, R.E.; Balko, B.A.; Lee, Y.T. (Lawrence Berkeley Lab., CA (USA)). Feb 1989. Contract AC03-76SF00098. 13p. (CONF-890274—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008307/JAW.

From International symposium on near-future chemistry in nuclear energy field; Ibaraki-Ken, Japan (15 Feb 1989).

A brief review of the application of the crossed molecular beams technique to the study of hot atom chemical reactions in the

last twenty years is given. Specific emphasis is placed on recent advances in the use of photolytically produced energetic deuterium atoms in the study of the fundamental elementary reactions D + H_2 {minus}> DH + H and the substitution reaction D + C_2H_2 {minus}> C_2HD + H. Recent advances in uv laser and pulsed molecular beam techniques have made the detailed study of hydrogen atom reactions under single collision conditions possible. 18 refs., 9 figs.

20206 (PER—164, pp 37-43) **Quality control of technetium-99m radiopharmaceuticals.** Van der Walt, T.N. Aug 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705936/JAW. (CONF-8808197—).

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

Primary radioisotopes and radiolabelled compounds are widely used for in vivo diagnostic studies in nuclear medicine. Strict quality control of these compounds is necessary. Sterility, apyrogenicity and chemical purity are important requirements for radiopharmaceuticals. This paper gives an overview of quality control and presents quality control tests on selected radiopharmaceuticals.

20207 (PER—164, pp 3-10) **Progress in the development of technetium-99m technology in South Africa.** Fourie, P.J. Aug 1988. V03/MF A01. Order Number DE88705936/JAW. (CONF-8808197—).

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

Since April 1974 the Isotope Production Centre at Pelindaba has made a considerable contribution to nuclear medicine in South Africa by producing 21 000 technetium-99m generators and a large number of technetium-99m labelling kits. Over the last 20 years technetium-99m has achieved a dominant position among the diagnostic tools in modern nuclear medicine. The value of the annual production of this radionuclide, on a worldwide scale, is estimated at $300 million. Many improvements and changes have been made to technetium-99m generators since they were introduced to nuclear medicine in the late 1950's. In the industrialized countries of the world the nuclear medicine profession is accustomed to using the portable chromatographic generator utilizing fission-molybdenum-99m as its common source of technetium-99m. The new Peltek-F sterile technetium-99m generator developed by the Isotope Production Centre is an excellent example of progress made in the development of technetium-99m technology in South Africa. This generator compares very favourable with some of the best in the world today especially with regard to performance, quality and safety. Although a large number of technetium-99m labelling kits are commercially available, much research is still going on and within the past few years a large number of physiologically relevant compounds have been labelled with technetium-99m and have been clinically tested in particular for brain perfusion studies, myocardial scintigraphy and the determination of total renal clearance. On a more limited scale researchers of the Isotope Production Centre are concentrating on some of the most important of these products. There are promising signs that with these new compounds the significance of technetium-99m in nuclear medicine will increase.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 19219, 19998, 19999, 20324

20208 (DOE/ER/13224—9) **Kinetic measurements on elementary fossil fuel combustion reactions over wide temperature ranges: Progress report.** (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemical Engineering). [1988]. Contract FG02-84ER13224. 6p. NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89008254/JAW.

This project provides kinetic data over wide temperature ranges on important combustion reactions. The HTP (high-temperature photochemistry) technique is used for the kinetic measurements. Additionally we have, in the past year, worked on the O + 1,3- butadiene and O + HCl reactions, as well as on the high-temperature photolysis of benzene. 6 refs.

20209 (K/PS—5077) **Testing of TSCA [Toxic Substances Control Act] incinerator for destruction of PCBs in uranium contaminated wastes.** Anderson, R.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1987. Contract AC05-84OT21400. 4p. (CONF-8710221—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007434/JAW.

From Electric Power Research Institute PCB seminar; Kansas City, MO, USA (6 Oct 1987).

A Toxic Substances Control Act (TSCA) incinerator for environmentally safe destruction of PCBs and hazardous organic materials contaminated with low level radioactive wastes from seven DOE facilities has been constructed at the Oak Ridge Gaseous Diffusion Plant, and has undergone performance testing with PCB surrogates. The system incorporates state-of-the-art off-gas treatment, a highly instrumented kiln and secondary combustion chamber, and an inert atmosphere solids handling feed system. Release of organic during an upset event, which triggers opening of the secondary combustion chamber relief vent, will be prevented by maintaining excess oxygen in the kiln and a high temperature in the secondary combustion chamber with an operating burner. Mixtures of chlorinated benzenes used in performance testing to simulate destruction of PCB, worst case studies to satisfy regulatory concerns, and implications of performance test results will be discussed. 4 refs.

20210 (LRAP—87) **Soot particle measurements in flat premixed flames using a pulsed laser and a scattering/extinction technique.** Bengtsson, P.E.; Alden, M. (Lund Univ. (Sweden). Dept. of Physics). 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757053/JAW.

A pulsed Nd:YAG laser been used to perform scattering/extinction measurements in flat, premixed methane/oxygen flames in order to determine soot particle sizes, number densities and soot volume fractions. Comparisons are made with the scattering/extinction technique where continuous wave laser is used for the scattering measurements and a tungsten strip filament lamp for the extinction measurements, and also, to some extent, with the dynamic light scattering techniques (DLS). Absorptions were measured through a referencing technique, where the laser-pulse intensity was normalizednby an internal reference laser-pulse intensity, thereby reducing the effect of pulse-to-pulse fluctuations. The incident laser fluence (pulse) (energy/area) was kept below 0.1 J/cm/sup 2/ in the focusing point in the flame to avoid soot vaporization effects. Despite this restriction, a high sensitivity in the scattering measurements was achieved, since the scatter factor detection limit was Q/sub VV/= 3 x 10/sup -11/ cm/sup -1/str/sup -1/, while the flame gas scatter factor was Q/sub VV/= 2.5 x 10/sup -9/ cm/sup -1/str/sup -1/. Interference in the measurements from polyaromatic hydrocarbons (PAH) is also discussed. (authors).

20211 (N—89-13547) **Modeling of hydrogen-air diffusion flame. Semiannual report.** Isaac, K.M. (Missouri Univ., Rolla (USA)). Dec 1988. 14p. (NASA-CR—181357; NAS—1.26:181357). NTIS, PC A03/MF A01.

Work performed during the first six months of the project duration for NASA Grant (NAG-1-861) is reported. An analytical and computational study of opposed jet diffusion flame for the purpose of understanding the effects of contaminants in the reactants and thermal diffusion of light species on extinction and reignition of diffusion flames is in progress. The methodologies attempted so far are described.

20212 (N—89-14402) **Effect of heat release on the spatial stability of a supersonic reacting mixing layer. Final report.** Jackson, T.L.; Grosch, C.E. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Nov 1988. 13p. (NASA-CR—181753; ICASE—88-68; NAS—1.26:181753). NTIS, PC A03/MF A01.

A numerical study of the stability of compressible mixing layers in which a diffusion flame is embedded is described. The mean velocity profile has been approximated by a hyperbolic tangent profile and the limit of infinite activation energy taken, which reduces the diffusion flame to a flame sheet. The addition of com-

bustion in the form of a flame sheet was found to have important, and complex, effects on the flow stability.

20213 **Rotational level dependent quenching of the A ^{3}Pi/sub i/, v' = 0 state of NH.** Garland, N.L.; Crosley, D.R. (Molecular Physics Laboratory, SRI International, Menlo Park, California 94025). *Journal of Chemical Physics;* **90**: No. 7, 3566-3573(1 Apr 1989).

Quenching cross sections σ/sub Q/ have been measured for several rotational levels N' in the A ^{3}product/sub i/, v' = 0 state of NH, for a variety of collision partners. Ground state NH was generated in a room temperature discharge flow and excited with a pulsed laser, and the time decay of fluorescence was measured. The radiative lifetime for the levels N' = 1 to 5 is 418 +- 8 ns. The σ/sub Q/'s are generally large, up to 90 A^2, and decrease with increasing N'. This indicates the influence of an anisotropic, attractive interaction in most but not all cases. The present values of σ/sub Q/ are compared with those of other experiments; because σ/sub Q/ depends both on N' and collision energy, experimental conditions must be carefully specified to yield results which are readily comparable.

20214 **Simultaneous measurement of Raman scattering and laser-induced OH fluorescence in nonpremixed turbulent jet flames.** Barlow, R.S.; Dibble, R.W.; Lucht, R. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94551-0969). *Optics Letters;* **14**: No. 5, 263-265(1 Mar 1989).

Spontaneous Raman scattering and laser-induced fluorescence are combined to perform simultaneous point measurements of major species concentrations, temperature, and hydroxyl radical concentration in turbulent nonpremixed flames. The Raman-scattering data for major species concentrations and temperature characterize the instantaneous, local, collisional quenching environment of the OH molecule. Collisional quenching corrections are applied for each laser shot so that absolute hydroxyl concentrations are obtained in turbulent flames using linear laser-induced fluorescence.

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REFER ALSO TO CITATION(S) 19671

20215 **(ICEFIZ-LOP—62-1988) Optical information processing and holography.** Vlad, V.I.; Ionescu-Pallas, N.; Popa, D.; Apostol, I. (Institutul Central de Fizica, Bucharest (Romania)). (Central Inst. of Physics, Bucharest (Romania)). Mar 1988. 25p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706011/JAW.

Some of our results in the optical information processing and holography are presented. (authors).

20216 **(ICEFIZ-LOP—66-1988) Laser-based measuring equipment controlled by microcomputer.** Miron, N.; Sporea, D.; Velculescu, V.G.; Petre, M. (Institutul de Fizica si Tehnologia Aparatelor cu Radiatii, Bucharest (Romania); Intreprinderea de mecanica fina, Bucuresti, Romania). (Central Inst. of Physics, Bucharest (Romania)). Mar 1988. 26p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706014/JAW.

Some laser-based measuring equipment controlled by microcomputer developed for industrial and scientific purposes are described. These equipments are intended for dial indicators verification, graduated rules measurement, and for very accurate measurement of the gravitational constant. (authors).

20217 **(N—89-14154) NASA/ASEE Summer Faculty Fellowship Program: 1988 research reports.** Anderson, L.A.; Armstrong, D.W. (National Aeronautics and Space Administration, Cocoa Beach, FL (USA). John F. Kennedy Space Center). Oct 1988. 562p. (NASA-CR—183406; NAS—1.26:183406). NTIS, PC A24/MF A01.

This contractor's report contains all sixteen final reports prepared by the participants in the 1988 Summer Faculty Fellowship Program. Reports describe research projects on a number of topics including controlled environments, robotics, cryogenic propellant storage, polymers, hydroponic culture, adaptive servocontrol, and computer aided design

20218 **(N—89-14896) NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1988.** Spencer, J. H. (Hampton Inst., VA (USA)). Sep 1988. 129p. (NASA-CR—181724; NAS—1.26:181724). NTIS, PC A07/MF A01.

Abstracts of research conducted as part of the 1988 Hampton University - NASA - Langley Research Center Summer Faculty Fellowship Research Program are given.

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REFER ALSO TO CITATION(S) 19293, 19422, 19425, 19569, 19572, 19601, 19612, 19656, 19806, 19895, 19896, 19897, 20038, 20061, 20064, 20275, 20276, 20399, 20401, 20402, 20405, 20406, 20407, 20408, 20409, 20415, 21455, 21521, 21548, 21549, 21550, 21551, 21552

20219 **(CONF-890153—3) Traction-drive force transmission for telerobotic joints.** Williams, D.M.; Kuban, D.P. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006687/JAW.

From NASA conference on space telerobotics; Pasadena, CA, USA (31 Jan 1989).

The US Space Station Program is providing many technological developments to meet the increasing demands of designing such a facility. One of the key areas of research is that of telerobotics for space station assembly and maintenance. Initial implementation will be teleoperated, but long-term plans call for autonomous robotics. One of the essential components for making this transition successful is the manipulator joint mechanism. Historically, teleoperated manipulators and industrial robotics have had very different mechanisms for force transmission. This is because the design objectives are almost mutually exclusive. A teleoperator must have very low friction and inertia to minimize operator fatigue; backlash and stiffness are of secondary concern. A robot, however, must have minimum backlash, and high stiffness for accurate and rapid positioning. A joint mechanism has yet to be developed that can optimize these divergent performance objectives. A joint mechanism that approaches this optimal performance was developed for NASA Langley, Automation Technology Branch. It is a traction-drive differential that uses variable preload mechanisms. The differential provides compact, dexterous motion range with a torque density similar to geared systems. The traction drive offers high stiffness and zero backlash---for good robotic performance, and the variable-loading mechanism (VLM) minimizes the drive-train friction---for improved teleoperation. As a result, this combination provides a mechanism to allow advanced manipulation with either teleoperated control or autonomous robotic operation. This paper will address the design principles of both of these major components of the joint mechanism. 4 refs., 8 figs.

20220 **(CONF-8807153—1) Rating and diagnostic parameters for high-speed, reciprocating-piston air compressors.** Liska, A.; Novak, P.; Wurm, J. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 17p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number DE89007152/JAW.

From Compressor engineering conference; West Lafayette, IN, USA (18 Jul 1988).

This paper documents the potential of using rating parameters of reciprocating air compressors as effective service diagnostic tools. One hundred twenty compressors were tested and the capacity correlations defined for volumetric efficiency, specific effective power inputs, and overall isothermal and isentropic efficiency for groups of designs. All of these parameters have been found suitable for the diagnostics of operation and the rating of new machines. The results of these experimental studies have been used to develop a bank of design data by analyzing and comparing the designs of over 1400 compressors worldwide. More recently, we investigated the possibility of using these results to define easily identifiable changes in operating parameters to judge the compressor state in

service. Such diagnostic elements were defined based on the rating parameters and used for developing operating standards to assess air compressor oil consumption, piston ring leakages, and valve leakages. The application of this work to the diagnosis of valve leakage is discussed in this paper. 10 figs., 3 tabs.

20221 **(CONF-8810316—1) Computer-aided x-ray imaging system design and evaluation.** Ciarcia, C.A.; Rupp, T.D. (EG and G Energy Measurements, Inc., Los Alamos, NM (USA). Los Alamos Operations). 1988. Contract AC08-88NV10617. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006599/JAW.

From Electronic imaging '88 conference; Boston, MA, USA (3 Oct 1988).

The use of x-ray imaging techniques, or radiography, as a diagnostic tool for scientific, industrial, and medical applications has increased appreciably in recent years. This increase is the result of new materials and state-of-the-art engineering techniques that have improved x-ray source design, shielding, and recording media. Radiography is now being used in many new applications where conventional optical photography traditionally has been limited or inappropriate. This new flexibility in x-ray imaging techniques has led to a broad latitude in the choice of radiographic system design that can be controlled to meet specific application needs. In many ways this design versatility is similar to that encountered when creating a specialized optical imaging system. Here image resolution and quality are optimized by undertaking analyses of geometrical parameters, ray-trace information, modulation transfer functions (MTFs), resolution grids, and image display or recording media, etc. This very flexibility in design, however, implies combining multiple components to create a complex system that contains many degrees of freedom. For conventional optical system design, this inherent complexity is overcome by using one of the computer design codes (for example, CODEV by Optical Research Associates). For the similar radiographic imaging problem, this paper discusses the x-ray image computer design code XRAD, which uses these same analysis techniques to optimize and predict the two-dimensional x-ray image of a three-dimensional object. 5 refs

20222 **(GA-A—19607) Integrated approach to trailer design for spent fuel casks.** Osborne, D.M.; Burgoyne, R.M.; Grenier, R.M.; Meyer, R.J. (General Atomics, San Diego, CA (USA)). Feb 1989. Contract AC07-88ID12698. 11p. (CONF-890207—8). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007644/JAW.

From Waste management '89; Tucson, AZ, USA (26 Feb 1989).

General Atomics (GA) is developing the GA-4 and GA-9 spent fuel transportation systems. The scope of our contract includes spent fuel casks, legal weight trailers, and ancillary equipment. Recent structural failures of spent fuel trailers have focused attention on trailer design. As a major element of spent fuel transportation systems, the concerns address the adequacy of trailer performance requirements, structural design and analysis, and in-service inspection and maintenance procedures. In response to these concerns, GA has applied an integrated approach to the design of the GA-4 and GA-9 transportation systems. The objectives are to design reliable, high-integrity trailers and to demonstrate their performance by test. Once the design is complete, a prototype trailer will be fabricated and a performance test program conducted in accordance with a comprehensive test program. GA's trailer test program will include both design and operations elements, and will be used to optimize the operations and maintenance plan. The results of this program will provide positive public and regulatory perception of trailer durability and will support the development of industry standards for both legal weight and overweight trailers for spent fuel applications. 2 figs.

20223 **(INIS-BR—1404) CW YLF Laser: Nd.** Rossi, W. de; Nogueira, G.E.C.; Vieira Junior, N.D.; Morato, S.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1987. 4p. (In Portuguese). (CONF-8705181—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705732/JAW.

From 10. national meeting on condensed matter physics; Caxambu, Brazil (5 May 1987).

Two continous solid state YLF: Nd lasers were fabricated. One of them presented and output of 380 mW for an input of 1000 W and the other an output of 1 W for an input of 2.000 W. (M.W.O.).

20224 **(INIS-BR—1420) Use of portable shields in industrial radiography.** Oliveira e Silva, J.A. de. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 16p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705743/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

This paper shows techniques actually used to reduce radiations exposure taxes during examinations execution by gamma radiography in regions of high population density. A portable equipment of radiation shield for using in exams by gamma radiography in pipelines, that is an adjustable device in an object body that will be examined, joining a measured collimator and a shield geometrically arranged so that the radiation restrict to impress the radiographic film used in examination without reaching people, objects or self-movings injurious that are nearness. (C.M.).

20225 **(JAERI-M—88-190) CASKETSS-DYNA3D: a nonlinear impact analysis computer program for nuclear fuel transport casks in three dimensional geometries.** Ikushima, Takeshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 100p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756907/JAW.

A nonlinear impact analysis computer program DYNA3D, which was developed by Hallquist, has been introduced from Lawrence Livermore National Laboratory for the purpose of using impact analysis of nuclear fuel transport casks. DYNA3D had been built in CASKETSS code system (CASKETSS means a modular code system for CASK Evaluation code system for Thermal and Structural Safety). Main features of DYNA3D are as follows; (1) This program has been programmed to provide near optimal speed on vector processing computers. (2) An explicit time integration method is used for fast calculation. (3) Many material models are available in the program. (4) A contact-impact algorithm permits gap and sliding along structural interfaces. (5) The graphic program for representations of calculation is provided. In the paper, brief illustration of calculation method, input data and sample calculations are presented.

20226 **(JAERI-M—88-191) Compilation of structural property data for computer impact calculation (1/5). Structural property data and data processing computer program.** Ikushima, Takeshi; Nagata, Norio. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 330p. (In Japanese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88756908/JAW.

The paper describes structural property data for computer impact calculations of nuclear fuel shipping casks. Four kinds of material data, mild steel, stainless steel, lead and wood are compiled. These materials are main structural elements of shipping casks. Structural data such as, the coefficient of thermal expansion, the modulus of longitudinal elasticity, the modulus of transverse elasticity, the Poisson's ratio and stress and strain relationships, have been tabulated against temperature or strain rate. This volume 1 involve structural property data and data processing computer program.

20227 **(LA—11418-MS) Artificial asteroid impact on defensive satellites.** Canavan, G.H. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008407/JAW.

Given the large projected Soviet space lift capacity, it is useful to ask whether its placing large amounts of mass in near-earth orbits could present a serious impediment to defensive satellites deployed there. This report uses a simple model to show that

such artificial asteroid belts are feasible and could directly limit the rate of deployment of defensive satellites in the near term, but are not necessarily an attractive, use of that lift capacity in the long term. 7 refs., 6 figs.

20228 **(LBL—26234) Nuclear magnetic resonance with dc SQUID [Super-conducting QUantum Interference Device] preamplifiers.** Fan, N.Q.; Heaney, M.B.; Clark, J.; Newitt, D.; Wald, L.; Hahn, E.L.; Bierlecki, A.; Pines, A. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 9p. (CONF-880812—42). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007657/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Sensitive radio-frequency (rf) amplifiers based on dc Superconducting QUantum Interface Devices (SQUIDS) are available for frequencies up to 200 MHz. At 4.2 K, the gain and noise temperature of a typical tuned amplifier are 18.6 +- 0.5 dB and 1.7 +- 0.5 K at 93 MHz. These amplifiers are being applied to a series of novel experiments on nuclear magnetic resonance (NMR) and nuclear quadrupole resonance (NQR). The high sensitivity of these amplifiers was demonstrated in the observation of "nuclear spin noise", the emission of photons by ^{35}Cl nuclei in a state of zero polarization. In the more conventional experiments in which one applies a large rf pulse to the spins, a Q-spoiler, consisting of a series array of Josephson junctions, is used to reduce the Q of the input circuit to a very low value during the pulse. The Q-spoiler enables the circuit to recover quickly after the pulse, and has been used in an NQR experiment to achieve a sensitivity of about 2 {times} 10^{16} nuclear Bohr magnetons in a single free precession signal with a bandwidth of 10 kHz. In a third experiment, a sample containing ^{35}Cl nuclei was placed in a capacitor and the signal detected electrically using a tuned SQUID amplifier and Q-spoiler. In this way, the electrical polarization induced by the precessing Cl nuclear quadrupole moments was detected: this is the inverse of the Stark effect in NQR. Two experiments involving NMR have been carried out. In the first, the 30 MHz resonance in ^{119}Sn nuclei is detected with a tuned amplifier and Q-spoiler, and a single pulse resolution of 10^{18} nuclear Bohr magnetons in a bandwidth of 25 kHz has been achieved. For the second, a low frequency NMR system has been developed that uses an untuned input circuit coupled to the SQUID. The resonance in ^{195}Pt nuclei has been observed at 55 kHz in a field of 60 gauss. 23 refs., 11 figs.

20229 **(LBL—26236) Hot electron effect in the dc SQUID.** Wellstood, F.; Urbina, C.; Clarke, J. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 5p. (CONF-880812—38). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007496/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

We have investigated the temperature dependence of the noise in thin-film dc Superconducting Quantum Interference Devices (SQUIDs) down to 20 mK. The white noise measured in the early versions of our SQUIDs did not decrease as the bath temperature was lowered below 150mK. We have attributed this saturation to a hot electron effect in the thin-film AuCu resistors shunting the Josephson junctions. A theoretical investigation showed that the temperature of the electrons in the shunts should be given by T/sub e/ = (P/ΣΩ)/sup 1/5/, where P is the power dissipated in the shunts, Ω is the shunt volume, and Σ is a proportionality constant. Experimentally, we found Σ = (2.4 {+-} 0.6) {times} 10^{9}WK/sup {minus}5/m/sup {minus}3/. We have redesigned the shunts, adding large thin-film cooling fins, to increase their volume substantially. This technique has reduced T/sub e/ to about 50 mK, with a corresponding improvement in the sensitivity of the SQUIDS. 9 refs., 4 figs., 2 tabs.

20230 **(N—89-14255) Leakage predictions for Rayleigh-step, helium-purge seals.** Proctor, M.P. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Dec 1988. 18p. (NASA-TM—101352; E—4379; NAS—1.15:101352). NTIS, PC A03/MF A01.

Rayleigh-step, helium purge, annular shaft seals, studied for use in liquid oxygen turbopumps, generate a hydrodynamic force that enables the seal to follow shaft perturbations. Hence, smaller clearances can be used to reduce seal leakage. FLOWCAL, a computer code developed by Mechanical Technology Incorporated, predicts gas flow rate through an annular seal with an axial pressure gradient. Analysis of a 50-mm Rayleigh-step, helium-purge, annular seal showed the flow rate increased axial pressure gradient, downstream pressure, and eccentricity ratio. Increased inlet temperature reduced leakage. Predictions made at maximum and minimum clearances (due to centrifugal and thermal growths, machining tolerances and + or - 2 percent uncertainty in the clearance measurement) placed wide boundaries on expected flow rates. The widest boundaries were set by thermal growth conditions. Predicted flow rates for a 50-mm Rayleigh-step, helium-purge, annular seal underestimated measured flow rates by three to seven times. However, the analysis did accurately predict flow rates for choked gas flow through annular seals when compared to flow rates measured in two other independent studies.

20231 **(N—89-14457) Analysis of shell-type structures subjected to time-dependent mechanical and thermal loading. Semiannual status report.** Simitses, G.J.; Riff, R. (Georgia Inst. of Tech., Atlanta (USA)). Oct 1988. 48p. (NASA-CR—183005; NAS—1.26:183005). NTIS, PC A03/MF A01.

The objective of this research is to develop a general mathematical model and solution methodologies for analyzing structural response of thin, metallic shell-type structures under large transient, cyclic or static thermomechanical loads. Among the system responses, which are associated with these load conditions, are thermal buckling, creep buckling and racheting. Thus, geometric as well as material-type nonlinearities (of high order) can be anticipated and must be considered in the development of the mathematical model. Furthermore, this must also be accommodated in the solution procedures.

20232 (N—89-14842, pp 129-146) **Processes and energy costs for mining lunar helium-3.** Sviatoslavsky, I.N. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

Preliminary investigations show that obtaining He-3 from the moon is technically feasible and economically viable. With the exception of beneficiation, the proposed procedures are state of the art. Mass of equipment needed from earth is of some concern, but resupply will eventually be ameliorated by the use of titanium from indigenous ilmenite. A complete energy payback from a D/He-3 fusion reactor utilizing lunar He-3 is approx. 80, providing ample incentive for commercial investment is forthcoming. Byproducts will be of great value to the resupply of a permanent lunar base and enhancement of space exploration.

20233 **(SAND—88-3058) Wake recontact: An experimental investigation using a ringslot parachute.** Strickland, J.H.; Macha, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1989. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008320/JAW.

A series of tests was conducted on a 10-ft.-diameter ringslot parachute with a geometric porosity of 20% to establish the conditions under which "wake recontact" occurs. The vertical helicopter drop tests covered a range of mass ratios from 0.5 to 3.0 and a range of Froude numbers from 70 to 400. Data consisted of velocity time histories obtained using a laser tracker and diameter time histories obtained from photometric data. A collapse parameter based on the ratio of the maximum parachute diameter to the subsequent minimum diameter was correlated with the mass ratio M/sub R/ and the Froude number Fr. This pair of similarity parameters was subsequently replaced by the equivalent pair M/sub R/ and V/sub o//V/sub t/ in order to provide more intuitive results (V/sub o//V/sub t/ is the initial to final velocity ratio). For large values of V/sub o//V/sub t/ the collapse parameter R/sub C/ appears to be a function of M/sub R/ alone. Non-dimensional opening time and "collapse time" data were also correlated with M/sub R/ and V/sub o//V/sub t/. In addition, opening load factors C/sub X/ were

calculated from the data and plotted as a function of V/sub o//V/ sub t/. 10 refs., 11 figs.

20234 **(SAND—88-3328) WhiteStar project engineering component selection database.** Rountree, S.L.K. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1989. Contract AC04-76DP00789. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008321/JAW.

The WhiteStar project is a cooperative effort among many directorates at Sandia National Laboratories Albuquerque to provide weapon and space systems design engineers with needed part characterization data. The purpose of WhiteStar is to encourage the use of standard parts through development of a user-convenient standard parts database containing quality design data and technical characteristics for standard electronic parts. WhiteStar is following the WhiteStar Project Requirements Document to guide the project design and implementation. WhiteStar project members are working with the SNLA Standard Parts Division to standardize the data requirements and to reflect those requirements in the WhiteStar database. There will be a phased incorporation of data by type/subtype. Continued discussions with engineering users will address user needs early and will assure users that the application product is user-oriented in its implementation. 4 refs., 2 figs.

20235 **(SAND—89-8419) Flight dynamics of a spinning projectile descending on a parachute.** Benedetti, G.A. (Sandia National Labs., Livermore, CA (USA)). Feb 1989. Contract AC04-76DR00789. 85p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008642/JAW.

During the past twenty years Sandia National Laboratories and the US Army have vertically gun launched numerous 155mm and eight-inch diameter flight test projectiles. These projectiles are subsequently recovered using an on-board parachute recovery system which is attached to the forward case structure of the projectile. There have been at least five attempts to describe, through analytical and numerical simulations, the translational and rotational motions of a spinning projectile descending on a parachute. However, none of these investigations have correctly described the large nutational motion of the projectile since all of them overlooked the fundamental mechanism which causes these angular motions. Numerical simulations as well as a closed form analytical solution show conclusively that the Magnus moment is responsible for the large nutational motion of the projectile. That is, when the center of pressure for the Magnus force is aft of the center of mass for the projectile, the Magnus moment causes an unstable (or large) nutational motion which always tends to turn the spinning projectile upside down while it is descending on the parachute. Conversely, when the center of mass for the projectile is aft of the center of pressure for the Magnus force, the Magnus moment stabilizes the nutational motion tending to always point the base of the spinning projectile down. The results of this work are utilized to render projectile parachute recovery systems more reliable and to explain what initially may appear to be strange gyrodynamic behavior of a spinning projectile descending on a parachute. 14 refs., 20 figs.

20236 **(TRI-PP—88-95) Analytic 3D image reconstruction using all detected events.** Kinahan, P.E.; Rogers, J.G. (TRIUMF, Vancouver, British Columbia (Canada)). Nov 1988. 5p. (CONF-881103—49). NTIS (US Sales Only), PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007648/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We present the results of testing a previously presented algorithm for three-dimensional image reconstruction that uses all gamma-ray coincidence events detected by a PET volume-imaging scanner. By using two iterations of an analytic filter-backprojection method, the algorithm is not constrained by the requirement of a spatially invariant detector point spread function, which limits normal analytic techniques. Removing this constraint allows the incorporation of all detected events, regardless of orientation, which improves the statistical quality of the final reconstructed image. 24 refs., 4 figs., 2 tabs.

20237 **(UCID—21649-Vol.2) Workshop on models to estimate military system probability of effect (P/sub E/) due to incident radiofrequency energy: Volume 2, Proceedings: The Pentagon.** Chesser, N.J. (comp.). (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 367p. (CONF-8806324—Vol.2). NTIS, PC A16/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008206/JAW.

From Workshop on models to estimate military system probability of effect (PE) due to incident radiofrequency energy; Washington, DC, USA (14 Jun 1988).

The material which follows summarizes the presentations and discussion which took place during a workshop held at the Pentagon in June 1988. The first five sections are summaries of individual presentations, not strictly in the order in which they were given, but rather divided into five topic areas and arranged within those areas in the order in which they were presented: Introduction; Proposed Approaches to P/sub K/; Methods from SDI LTH; Lessons from the EMP/EMI/EMC Community; HPM Testing Methodology. Where appropriate, comments made during those presentations are noted within curly brackets {l←brace}...{ r←brace}. Section Six summarizes the observations made and issues raised during the working session on the afternoon of the second day.

20238 **(VTT-TIED—911) Contamination analysis of lubrication oils and hydraulic oils.** Vaelttilae, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Nov 1988. 47p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757112/JAW.

This literature survey deals with the use of the contamination analysis of lubrication oils and hydraulic oils in an industrial environment in the condition monitoring of machinery of machinery. In addition to normal metallic wear particles solid contaminants can come into the lubrication or hydraulic system from outside or the oil itself can generate solid contaminants. The following contamination analysis methods are presented: gravimetric analysis, microscopic and automatic particle counting, ferrography and spectrometrical oil analysis. The combined use of different methods is also discussed. There are only minor differences in sensitivity between these methods. The sensitivity depends on the application. The reliability of predicting the initial failure depends more on the oil sampling frequency than on the used method. All these methods can be applied on the condition monitoring based on trend analysis.

20239 **Dynamic high pressure process for fabricating superconducting and permanent magnetic materials.** Nellis, W.J.; Brian, M.; Geballe, T.H. (to Dept. of Energy, Washington, DC). US Patent 4,762,754. 9 Aug 1988. Filed date 23 Oct 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for producing superconducting electric and magnetic circuit components. The steps consists of: disposing powder superconducting ceramic oxide between sheets of conductive metal in a shock dissipative backing environment; generating a supersonic shockwave generally normal to planes of the sheets of conductive metal and the layer of ceramic oxide to thereby compact the powdered ceramic oxide into a densified superconducting body having superconducting current paths therethrough enclosed in and integral with the sheets of conducting metal.

20240 **A program for evaluating the effects of short circuits in coil systems.** Pillsbury, R.D. Jr.; Thome, R.J.; Mann, W.R.; Minervini, J.V. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, MA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1536-1549(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The occurrence of a short circuit adds a current branch to a coil system which can impact its operation by affecting design conditions in three major areas - electromagnetic forces, temperatures, and voltages. Failure mode analysis involving possible short circuits is conceptually straightforward, but tedious in multiple coil system because of the necessity for combining field analysis, parameter de-

terminations (inductances), transient cirucit analyses, and failure condition estimated. SHORTFORCE is set of FORTRAN programs that is designed to aid in model construction (e.g. short definition), circuit parameter calculations and display of output currents, fields, and forces, etc. The program is described and an example case presented with comparisons with measured data from a shorted superconducting coil.

20241 **Designs of pulsed power cryogenic transformers.** Singh, S.K.; Heyne, C.J.; Hackowrth, D.T.; Shestak, E.J.; Eckels, P.W.; Rogers, J.D. (Westinghouse R and D Center, Pittsburgh, PA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1504-1507(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The Westinghouse Electric Corporation has completed designs of three pulsed power cryogenic transformers of three pulsed power cryogenic transformers for the Los Alamos National Laboratory. These transformers will be configured to transfer their stored energy sequentially to an electro-magnetic launcher and form a three-stage power supply. The pulse transformers will act as two winding energy storage solenoids which provide a high current and energy pulse compression by transforming a 50 kA power supply into a megamp level power supply more appropriate for the electromagnetic launcher duty. This system differs from more traditional transformer applications in that significant current levels do not exists simultaneously in the two windings of the pulse transformer. This paper describes the designs of the pulsed power cryogenic transformers.

20242 **Development and testing of laminated conductors for the CIT TF coils.** Brown, G.M.; Murray, H.; Rogoff, P. (Princeton Plasma Physics Lab., P.O. Box 451, Princeton, NJ (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1515-1519(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Fabrication techniques and mechanical property characterizations are presented for a laminated composite plate. The significant reinforcement which is provided by plates on either side of a central copper plate is shown in both finite element analyses and in experimental data obtained in compression at room temperature. Applications to magnet structures are discussed, with their influence on the design of a testing program to adequately characterize the mechanical response of this structural composite.

20243 **Modeling the behavior of oriented permanent magnet material using current doublet theory.** Green, M.A. (Lawrence Berkeley Lab., Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1528-1531(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

This paper presents a method for modeling two dimensional dipoles, quadrupoles and other higher multipoles built using oriented permanent magnet materials such as samarium cobalt (one of the rare earth cobalt REC materials). The technique presented here uses complex current doublet to model the magnetized material. This technique can be used in conjunction with an infinitely permeable circular iron shield which lies outside the REC material. Examples of two types of dipoles and quadrupoles are presented in this report.

20244 **The US-DPC, a poloidal coil test insert for the Japanese Demonstration Poloidal Coil Test Facility.** Steeves, M.M.; Hoenig, M.O.; Minervini, J.V.; Gibson, C.R.; Morra, M.M.; Martini, J.L.; Ballinger, R.G.; Autler, S.; Ichihara, T.; Randall, R. (Massachusetts Institute of Technology, Plasma Fusion Center, Cambridge, MA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1307-1310(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A superconducting pulsed poloidal coil is being built by MIT to be tested in 1989 in the Japan Atomic Energy Research Institute (JAERI) Demonstration Poloidal Coil Test Facility (DPCF). This coil will consist of three double pancakes of Nb/sub 3/Sn cable-in-conduit conductor operating at a maximum coil-envelope current density of 50 A/mm/sup 2/ at 4.2 K in a peak field of approximately 10 T. Peak current and peak ramped field will be 30 kA and approximately 10 T/s respectively. The coil, conductor, proposed experiment, and supporting R and D are described.

20245 **Measurements of magnetic field alignment.** Kuchnir, M.; Schmidt, E.E. (Fermi National Accelerator Lab., Batavia, IL (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 950-953(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The procedure for installing Superconducting Super Collider (SSC) dipoles in their respective cryostats involves aligning the average direction of their field with the vertical to an accuracy of 0.5 mrad. The equipment developed for carrying on these measurements is described and the measurements performed on the first few prototypes SSC magnets are presented. The field angle as a function of position in these 16.6 long magnets is a characteristic of the individual magnet with possible feedback information to its manufacturing procedure. A comparison of this vertical alignment characteristic with a magnetic field intensity (by NMR) characteristic for one of the prototypes is also presented.

20246 **Design, fabrication, and calibration of a cryogenic search-coil array for harmonic analysis of quadrupole magnets.** Green, M.I.; Barale, P.J.; Hassenzahl. W.V.; Nelson, D.H.; O'Neill, J.W.; Schafer, R.V.; Taylor, C.E. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 954-957(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A cryogenic search-coil array has been fabricated at LBL for harmonic error analysis of SSC model quadrupoles. It consists of three triplets of coils; the center-coil triplet is 10 cm long, and the end col triplets are 70 cm long. Design objectives are a high bucking ratio for the dipole and quadrupole signals and utility at cryogenic operating currents (—6 kA) with sufficient sensitivity for use at room-temperature currents (—10 A). The design and fabrication are described. Individual coils are mechanically measured to +-5 μm, and their magnetic areas measured to 0.05%. A computer program has been developed to predict the quadrupole and dipole bucking ratios from the mechanical and magnetic measurements. The calibration procedure and accuracy of the array are specified. Results of measurements of SSC model quadrupoles are presented.

20247 **Development of a laced electromagnetic wiggler.** Christensen, T.C.; Burns, M.J.; Deis, G.A.; Parkison, C.D.; Halbach, K. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, L-629, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1094-1097(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The laced electromagnetic wiggler is a new concept being developed to attain higher magnetic fields, shorter wavelengths, and larger gaps for the induction-linear accelerator, free-electron-laser (FEL) program. In the laced wiggler design, permanent magnets are located ("laced") between the electromagnetic coils to increase the reverse-bias flux in the iron pole beyond that possible with only pole-edge ("side") permanent magnets. This increase in reverse-bias flux allows wiggler operation at midplane magnetic field intensities comparable to those of a hybrid permanent magnet/steel wiggler, but with field adjustability over a specified range. The maximum field intensity and tuning range are selected, within limits, for specific design requirements. The authors have designed and tested a one-period prototype of this concept with promising results.

20248 Stability and refrigeration of magnet cryosystems near 1.8 K using the thermomechanical effect. Frederking, T.H.K.; Chen, W.E.W.; Caspi, S. (Univ. of California, Los Angeles, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1117-1120(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Superconducting magnets may exhibit a significantly increased critical surface when the operating temperature is lowered, e.g. with NbTi-based alloys. Further, stability associated with superconductor-coolant interaction is enhanced in superfluid Helium-4 (= He II), provided the coolant ducts have been optimized. The use of He II has been promoted in several large systems. The present work investigates magnet cryosystem options which utilize the thermomechanical effect (fountain effect) of He II. Examples are presented for simplified thermodynamic state changes of cycle operation.

20249 Superconducting magnet system for a space-based 100 MW MHD disk generator. Marston, P.G. (MIT Plasma Fusion Center, Cambridge, MA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 885-886(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The conceptual design of a 6 T superconducting magnet system for a space-based 100 MW single-coil MHD disk generator is described. Overall cold-mass dimensions are 2.325 m diameter by 0.15 m thickness. Average current density in the winding is 1.8 x 10/sup 8/ A/m/sup 2/. Stored energy is 45 MJ. Total system weight is 5000 kg.

20250 The Livermore free-electron laser program magnet test laboratory. Burns, M.J.; Kulke, B.; Desi, G.A.; Frye, R.W.; Kallman, J.S.; Ollis, C.W.; Tyler, G.C.; Van Maren, R.D.; Weiss, W.C. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, L-628, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 918-921(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The Lawrence Livermore National Laboratory (LLNL) Free-Electron Laser Program Magnet Test Laboratory supports the ongoing development of the Induction Linac Free Electron Laser (IFEL) and uses magnetic field measurement systems that are useful in the testing of long periodic magnetic structures, electron-beam transport magnets, and spectrometer magnets. The major systems described include two computer-controlled three-axis Hall probe-and-search coil transports with computer-controlled data acquisition; a unique, automated-search coil system sued to detect very small inaccuracies in wiggler fields; a nuclear magnetic resonance (NMR)-based Hall probe-calibration facility; and a high-current DC ion source using heavy ions of variable momentum to model the transport of high-energy electrons. Additionally, a high-precision electron-beam-position monitor for use within long wigglers that has a positional resolution of less than 100 μm is under development in the laboratory and will be discussed briefly. Data transfer to LLNL's central computing facility and on-line graphics enable us to analyze large data sets quickly.

20251 High temperature oxide superconductors. Larbalestier, D. (Applied Superconductivity Center and Dept. of Metallurgical Engineering, Univ. of Wisconsin-Madison (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 711-718(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The state of knowledge about high temperature oxide superconductors, with particular reference to their potential for high field magnet use is reviewed. After a brief discussion of the structural and physical properties, attention is drawn to the high field superconducting properties. The problem of the large gap between the magnetization current density (J/sub cm/) and the transport critical current density (J/sub ct/) is described and various ideas concerning the weak links responsible for this gap are explored. The authors conclude with a brief overview of the principal challenges facing the use of oxides for high field magnet use.

20252 Development and characterization of aluminum clad superconductors. Kanithi, H.; Phillips, D.; King, C.; Zeitlin, B. (Intermagnetics General Corp., 1875 Thomaston Avenue, Waterbury, CT (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1029-1032(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A new fabrication technique has been developed to clad conventional NbTi/Cu composite conductors with high purity aluminum. The technique is capable of high volume production. A variety of sizes and shapes of practical superconductors has been clad using aluminum of initial residual resistance ratios ranging from 200:1 to 3000:1. The quality of bond between Al and Cu has been investigated metallographically and by shear strength tests. Electrical properties, such as the current carrying capacity and RRR as a function of magnetic field for several Al stabilized conductors have been measured. The results of the investigation will be presented in this paper. The unique advantages of the Al clad conductors over the fully copper stabilized configurations will be discussed. The advanced conductors developed here will be particularly suitable for large magnet applications such as high field MRI, high energy physics particle detectors and magnetic energy storage.

20253 Experience with measuring magnetic moments of permanent magnet blocks at Lawrence Berkeley Laboratory. Nelson, D.H.; Barale, P.J.; Green, M.I.; Van Dyke, D.A. (Magnetic Measurements Engineering Group, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1098-1101(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Since May 1985, the Magnetic Measurements Engineering Group at LBL has measured and sorted a total of 3834 permanent magnet blocks. These magnetic blocks have been used in the construction of various successful beam-line elements including dipoles, quadrupoles, and wigglers. The authors report on observed variations in magnetic moments among blocks supplied by five manufacturers, describe the operational capabilities (accuracy, precision, and resolution) of the LBL Magnetic-moment Measurement and Sorting System (MMSS), cite the results of comparative calibrations by permanent-magnet manufacturers and other National Laboratories, and suggest criteria for automating the MMSS for measuring the large number of permanent-magnet blocks required for the insertion devices for the projected LBL 1-2 GeV Synchrotron Radiation Source.

20254 Testing of the EURATOM LCT coil in the toroidal arrangement of the International Fusion Superconducting Magnet Test Facility without external pulsed fields (standard-1) and with them (standard II) and an extended single-coil test. Friesinger, G.; Gauss, S.; Komarek, P.; Lubell, M.S.; McManamy, T.J.; Maurer, W.; Shen, S.S.; Siewerdt, L.; Ulbricht, A.; Wuchner, F. (Kernforschungszentrum Karlsruhe, Institut fur Technische Physik Postfach 640, D-7500 Karlsruhe (DE)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 775-778(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Testing of the European LCT coil, a forced-flow NbTi coil, with the five other coils in the International Fusion Superconducting Magnet Test Facility (IFSMTF) has been in progress since the beginning of 1986. By the end of July 1987, the Euratom-LCT coil had passed a single-coil test, a test in toroidal configuration with and without poloidal field transients, and an extended single-coil test up to its design limits. In this test, the coil reached, in stable operation, a field of 9 T at 140% of rated current. It reached the short-sample values of the strands used in the cable. The coil was operated up to 8 T with and without poloidal field transients in a

toroidal configuration. The mass flow rate was reduced by a factor of 5 compared with the design value without any visible impact on stability. Averaged ac losses (winding, 14 W; case, 7 W) were measured under LCT specified poloidal field pulses, and the findings agreed with those of the short-sample measurements. The mechanical properties behaved as predicted by calculations. No global movement of the winding in the coil case was found, although the coil has already experienced 50% (14MN) of the maximum out-of-plane force. The operating limits were determined by measuring the current-sharing temperature. It was found that the helium mass flow rate had an impact on the hot-spot temperature of a normal region. All results obtained demonstrate that the applied technology has achieved reliable engineering standards.

20255 **Stability tests of the Westinghouse coil in the International Fusion Superconducting Magnet Test Facility.** Dresner, L.; Fehling, D.T.; Lubell, M.S.; Lue, J.W.; Luton, J.N.; McManamy, T.J.; Shen, S.S.; Wilson, C.T. (Oak Ridge National Lab., P.O. Box Y, Bldg. 9204-1, MS14, Oak Ridge, TN (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 779-782(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The Westinghouse coil is one of three forced-flow coils in the six-coil toroidal array of the International Fusion Superconducting Magnet Test Facility at Oak Ridge National Laboratory. It is wound with an 18-kA, Nb/sub 3/Sn/Cu, cable-in-conduit superconductor structurally supported by aluminum plates and cooled by 4-K, 15-atm supercritical helium. The coil has been tested both individually and in the six-coil array. The tests covered charging to full design current and field, measuring the current-sharing threshold temperature using the resistive heaters, and measuring the stability margin using the pulsed inductive heaters. At least one section of the conductor exhibits a very broad resistive transition. The broad transition, though causing the appearance of voltage at relatively low temperatures, does not compromise the stability margin of the coil, which was greater than 1.1J/cm/sup 3/ of strands. In another nonresistive location, the stability margin was between 1.7 and 1.9 J/cm/sup 3/ of strands. The coil is completely stable in operation at 100% design current in both the single- and six-coil modes.

20256 **Systematics of excimer laser ablation - Thin film preparation of high T/sub c/ material.** Neifeld, R.A.; Gunapala, S.; Liang, G.; Shaheen, S.A.; Croft, M.; Price, J.; Simons, D.; Hill, W.T. III; Ginley, D. (US Army LABCOM, Harry Diamond Labs., Adelphi, MD (US); Dept. of Physics and Astronomy, Rutgers Univ., Piscataway, NJ (US); US Navy - Navy Surface Warfare Center, Silver Spring, MD (US); Institute for Applied Science and Technology, Univ. of Maryland, College Park, MD (US); Sandia National Lab., Albequerque, NM (US)). pp v of Processing and applications of high Tc superconductors. Mayo, W.E. Warrendale, PA; The Metallurgical Society Inc. (1988). (CONF-880519—).

From 4. northeast regional meeting on processing and applications of high {Tc} superconductors; New Brunswick, NJ, USA (9 May 1988).

Excimer laser ablation was used to prepare thin films from bulk targets of Y-Ba-Cu-O, Sm-Ba-Cu-O, and Bi-Sr-Ca-Cu-O. The systematic variation in film thickness, stoichiometry, and microstructure, as a function of laser fluence and angle from the target surface normal was determined. At laser fluence above a few J/cm/sup 2/ the film composition is uniform over wide solid angles. Deposition rate increases with laser fluence. For the Sm and Bi based materials film stoichiometry replicates the target composition at high laser fluence. These results can be understood in terms of the sudden creation of a dense gas layer at the target surface, and unity sticking coefficients at the substrate. The Y based films, however, are deficient in Ba and Cu at such laser fluence. The effect of moderate temperature processing upon interface sharpness for GaAs and Si based substrates and several of the high T/sub c/ materials was investigated.

20257 **Timely information on safeguards equipment.** Auerbach, C.; Biittner, B.J.; Kirby, D.K. (Brookhaven National Lab., Upton, NY (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 507-510(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

A second edition of Safeguards Instrumentation: A computer-based Catalog was published in 1985 at the request of the U.S. Department of Energy, Office of Safeguards and Security (DOE-OSS). The object of the revision was to keep the information up-to-date, so as to promote effective safeguards and assist in long-range planning. Orientation and format of the original edition were left basically unchanged. The document was generated from a database that had been developed for the original edition and that continues to be stored in a HP-3000 computer located at BNL. The database can be readily accessed by TSO personnel for updating or other modifications on a continuous basis. It may also be accessed, under certain conditions, by individuals outside BNL for information or searches. If kept up-to-date, the database provides a useful mechanism for keeping the safeguards community informed on availability and approximate cost of relevant instrumentation.

20258 **Mixing liquid holding tanks for uniform concentration.** Sprouse, K.M. (Rockwell International/Rocketdyne Div., Canoga Park, CA (US)). *Nuclear Materials Management. Annual Meeting Proceedings;* **17**: 834-839(1988). (CONF-880631—).

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Achieving uniform concentration within liquid holding tanks can often times be a difficult task for the nuclear chemical process industry. This is due to the fact that nuclear criticality concerns require these tanks to be designed with high internal aspect ratios such that the free movement of fluid is greatly inhibited. To determine the mixing times required to achieve uniform concentrations within these tanks, an experimental program was conducted utilizing pencil tanks, double-pencil tanks, and annular tanks of varying geometries filled with salt-water solutions (simulant for nitric acid actinide solutions). Mixing was accomplished by air sparging and/or pump recirculation. Detailed fluid mechanic mixing models were developed --from first principles--to analyze and interpret the test results. These nondimensional models show the functionality of the concentration inhomogeneity (defined as the relative standard deviation of the true concentration within the tank) in relationship to the characteristic mixing time--among other variables. The results can be readily used to scale tank geometries to sizes other than those studied here.

4203 Lasers

REFER ALSO TO CITATION(S) 21449, 21545, 21556

20259 **(ANL/PPRNT—89-160) Gamma rays for pedestrians.** Lipkin, H.J. (Argonne National Lab., IL (USA)). 7 May 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008347/JAW.

Nuclear gamma radiation does not have many of the properties taken for granted in atomic or molecular radiation and necessary for lasers. The basic science and technology underlying these differences and the proposed methods of overcoming difficulties resulting from them are not properly understood. Considerable illumination in this interdisciplinary problem could be provided by some back-of-the-envelope calculations and simple experimental surveys by small groups of students and postdocs with an elementary knowledge of the nuclear and solid state physics which is evidently not familiar these days to laser physicists. 3 refs.

20260 **(LA-UR—89-151) Nuclear-pumped lasers for large-scale applications.** Anderson, R.E.; Leonard, E.M.; Shea, R.E.; Berggren, R.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881244—7). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006532/JAW.

From LASERS '88; Lake Tahoe, NV, USA (5 Dec 1988).

Efficient initiation of large-volume chemical lasers may be achieved by neutron induced reactions which produce charged particles in the final state. When a burst mode nuclear reactor is used as the neutron source, both a sufficiently intense neutron flux and a sufficient short initiation pulse may be possible. Proof-of-principle experiments are planned to demonstrate lasing in a direct nuclear-pumped large-volume system: to study the effects of various neutron absorbing materials on laser performance; to study the effects of long initiation pulse lengths; to determine the performance of large-scale optics and the beam quality that may bo obtained; and to assess the performance of alternative designs of burst systems that increase the neutron output and burst repetition rate. 21 refs., 7 figs., 5 tabs.

20261 **(LA-UR—89-560) Intensity-induced absorption in ZnSe.** Sollid, J.E.; Feldman, D.W.; Phipps, C.R. Jr.; Warren, R.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-881258—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007986/JAW.

From Lasers '88 conference; Lake Tahoe, CA, USA (5 Dec 1988).

In a particular sample of ZnSe, working at 10 μm, a nonlinear absorption was observed that was generated by light intensities greater than 100 MW/cm². This absorption was subsequently bleached by light intensities over 600 MW/cm². This result was obtained using 10-ps pulses from the Los Alamos National Laboratory Free-Electron Laser. 5 refs., 4 figs.

20262 **(N—89-14426) High-power AlGaAs channeled substrate planar diode lasers for spaceborne communications. Final report, 4 August 1986-15 July 1987.** Connolly, J.C.; Goldstein, B.; Pultz, G.N.; Slavin, S.E.; Carlin, D.B.; Ettenberg, M. (David Sarnoff Research Center, Princeton, NJ (USA)). Nov 1988. 168p. (NASA-CR—4189; NAS—1.26:4189). NTIS, PC A08/MF A01.

A high power channeled substrate planar AlGaAs diode laser with an emission wavelength of 8600 to 8800 A was developed. The optoelectronic behavior (power current, single spatial and spectral behavior, far field characteristics, modulation, and astigmatism properties) and results of computer modeling studies on the performance of the laser are discussed. Lifetest data on these devices at high output power levels is also included. In addition, a new type of channeled substrate planar laser utilizing a Bragg grating to stabilize the longitudinal mode was demonstrated. The fabrication procedures and optoelectronic properties of this new diode laser are described.

20263 **(N—89-14427) Investigation of RF excited CW CO_2 waveguide lasers local oscillator - RF excitation. Final report.** Hochuli, U. (Maryland Univ., College Park (USA)). May 1988. 24p. (NASA-CR—183344; NAS—1.26:183344). NTIS, PC A03/MF A01.

A new local oscillator housing was built which seems to have improved laser life. Laser cooling was changed from internal water cooling to the more convenient thermal contact cooling. At the present time, a conclusion can not be made if the 20 percent reduction in power output is the result of poorer cooling or poorer grating alignment. The coupling-starting network was improved from 55 to about 90 percent. It can be adjusted by varying trimmers C sub 1 and C sub 2 to match RF power levels between 10 and 30 W. If the laser admittance changes greatly with laser life rematching will have to be achieved by remote control for space applications. The same holds true if the RF power level has to be changed with a maximum efficiency constraint.

20264 **(UCID—21578) Atmospheric effects on laser propagation.** Karr, T.J. (Lawrence Livermore National Lab., CA (USA)). 22 Nov 1988. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008646/JAW.

The linearized theory of thermal blooming instabilities is reviewed. The dispersion relation is derived for unstable modes with and without correction. Perfect phase-only correction is unstable at all spatial scales, while perfect field conjugation is stable at all scales. Various atmospheric phenomena, such as turbulence, diffusion and wind shear may mitigate or dampen the instabilities. Full nonlinear time-dependent computer simulations of laser atmospheric propagation agree with the dispersion relation for small perturbations, and show saturation and nonlinear mode beating at long times. 2 refs., 7 figs.

20265 **(UCID—21591) Magnetic axis alignment and the Poisson alignment reference system.** Griffith, L.V.; Schenz, R.F.; Sommargren, G.E. (Lawrence Livermore National Lab., CA (USA)). 31 Jan 1989. Contract W-7405-ENG-48. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007687/JAW.

Three distinct metrological operations are necessary to align a free-electron laser (FEL): the magnetic axis must be located, a straight line reference (SLR) must be generated, and the magnetic axis must be related to the SLR. This paper begins with a review of the motivation for developing an alignment system that will assure better than 100-μm accuracy in the alignment of the magnetic axis throughout an FEL. The paper describes techniques for identifying the magnetic axis of solenoids, quadrupoles, and wiggler poles. Propagation of a laser beam is described to the extent of revealing sources of nonlinearity in the beam. Development and use of the Poisson line, a diffraction effect, is described in detail. Spheres in a large-diameter laser beam create Poisson lines and thus provide a necessary mechanism for gauging between the magnetic axis and the SLR. Procedures for installing FEL components and calibrating alignment fiducials to the magnetic axes of the components are also described. An error budget shows that the Poisson alignment reference system will make it possible to meet the alignment tolerances for an FEL. 21 refs., 27 figs., 3 tabs.

20266 **(UCID—21624) A comparison calculation using Beam 2.** Wainwright, T.; Maenchen, G. (Lawrence Livermore National Lab., CA (USA)). Feb 1989. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008648/JAW.

20267 **(UCID—21639) Induction accelerators and free-electron lasers at LLNL: Beam Research Program.** Briggs, R.J. (Lawrence Livermore National Lab., CA (USA)). 15 Feb 1989. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007691/JAW.

Linear induction accelerators have been developed to produce pulses of charged particles at voltages exceeding the capabilities of single-stage, diode-type accelerators and at currents too high rf accelerators. In principle, one can accelerate charged particles to arbitrarily high voltages using a multistage induction machine. The advent of magnetic pulse power systems makes sustained operation at high repetition rates practical, and high-average-power capability is very likely to open up many new applications of induction machines. In Part A of this paper, we survey the US induction linac technology, emphasizing electron machines. We also give a simplified description of how induction machines couple energy to the electron beam to illustrate many general issues that designers of high-brightness and high-average-power induction linacs must consider. We give an example of the application of induction accelerator technology to the relativistic klystron, a power source for high-gradient accelerators. In Part B we address the application of LIAs to free-electron lasers. The multikiloampere peak currents available from linear induction accelerators make high-gain, free-electron laser amplifier configurations feasible. High extraction efficiencies in a single mass of the electron beam are possible if the wiggler parameters are appropriately "tapered", as recently demonstrated at millimeter wavelengths on the 4-MeV ELF facility. Key issues involved in extending the technology to shorter wavelengths and higher average powers are described. Current FEL experiments at LLNL are discussed. 5 refs., 16 figs.

20268 **High-efficiency TEM_{00} continuous-wave (Al,Ga)As epitaxial surface-emitting lasers and effect of half-wave periodic gain.** Gourley, P.L.; Brennan, T.M.; Hammons, B.E.; Corzine, S.W.; Geels, R.S.; Yan, R.H.; Scott, J.W.; Coldren, L.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **54**: No. 13, 1209-1211(27 Mar 1989).

We report room-temperature, continuous-wave (cw), photopumped operation of (Al,Ga)As surface-emitting lasers grown by molecular beam epitaxy. These monolithic semiconductor lasers comprise two multilayer semiconductor mirrors surrounding a layered active region. In the active region, GaAs quantum wells are spaced with half-wave periodicity to center on standing-wave maxima of the cavity optical field. By comparing threshold data for different lasers grown with and without half-wave periodicity, we observe the first experimental evidence for reduced cw lasing threshold (as low as 2 x 10^4 W/cm^2) with periodic gain in an epitaxial surface-emitting laser. Up to 50 mW with high efficiency (35% total, 80% differential) and narrow spectral linewidth (2 A) have been measured. A very high quality beam with low divergence (2.5°) and circular TEM/sub 00/ profile has been observed. All of these observations represent significant advances for surface-emitting laser technology.

20269 **Nonlinear index of air at 1.053 μm.** Pennington, D.M.; Henesian, M.A.; Hellwarth, R.W. (Lawrence Livermore National Laboratory, P.O. Box 5508, L-493, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **39**: No. 6, 3003-3009(15 Mar 1989).

We have measured absolutely the intensity-dependent change in the state of elliptical polarization of a well-characterized 1-ns laser beam propagating in 68 m of air, at intensities ranging from 0.5 to 1.5 GW/cm^2. From the data we deduce a value for the nonlinear susceptibility coefficient c/sub 1221/(-ω,ω,ω,-ω) for air at 20 °C and 1.053 μm of (20 +- 5) x 10/sup -19/ esu, corresponding to a nonlinear index n_2 = 1.0 x 10/sup -16/ cm^3 erg/sup -1/. This value is consistent with the value inferred from low-power Kerr and harmonic-generation measurements in O_2 and N_2, but it is approximately one half of a previously reported experimental value for air. We also replaced 58 m of the air path with argon gas at 1 atm pressure and verified that a substantial reduction in nonlinear beam refraction can thereby be achieved.

20270 **Dark optical solitons with finite-width background pulses.** Tomlinson, W.J.; Hawkins, R.J.; Weiner, A.M.; Heritage, J.P.; Thurston, R.N. (Bellcore, Red Bank, New Jersey 07701-7040). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 329-334(Mar 1989).

Using numerical solutions of the nonlinear Schroedinger equation, we show that for positive group-velocity dispersion, optical dark pulses superimposed upon background pulses only ~10 x wider can exhibit stable soliton propagation in single-mode fibers. During propagation the background pulse spreads (which reduces its intensity) and develops a frequency chirp. Nevertheless, as the background pulse evolves the dark pulse adiabatically maintains its soliton characteristics. These numerical results are in excellent agreement with recent experimental investigations of dark-pulse propagation in fibers.

20271 **Lossless propagation of optical pulses through N-level systems with SU(2) symmetry.** Hioe, F.T. (Department of Physics, St. John Fisher College, Rochester, New York 14618). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 335-343(Mar 1989).

Propagation of optical pulses through atomic media consisting of atoms with N transition levels and possessing the so-called SU(2) symmetry is studied. It is shown that there are generally N - 1 sets of conditions, each of which, when satisfied, would permit the appropriate Maxwell—Bloch equations to have a solution having the form of simultaneous different-wavelength optical solitons, so-called simultons. The first two sets of solutions were known previously, but the remaining sets are new.

20272 **Measurement of the local laser intensity by photoelectron energy shifts in multiphoton ionization.** Perry, M.D.; Landen, O.L.; Szoeke, A. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 344-349(Mar 1989).

We present the use of a new technique to measure the local intensity present at the laser focus. The technique is based on the ponderomotive energy shift of photoelectrons produced by multiphoton ionization with a short laser pulse. If the laser intensity is sufficient to saturate the ionization probability, the technique may be used to determine multiphoton-ionization cross sections accurately. Measurements of cross sections using this technique for the four-photon ionization of krypton at 293 nm are presented.

20273 **Thulium YAG laser operation at 2.01 μm.** Storm, M.E.; Gettemy, D.J.; Kokta, M.R.; Barnes, N.P.; Cross, P.L. (ST Systems Corporation, Hampton, Virginia 23666). *Applied Optics;* **28**: No. 3, 408-409(1 Feb 1989).

Laser experiments were performed on two samples of Tm:Cr:YAG. The primary motivation for studying Tm:Cr lasers is to achieve pulsed Q-switch performance which has been problematic in Ho:Tm:Cr material because of energy transfer considerations.(AIP)

20274 **Production techniques for the PALADIN free-electron laser wiggler magnets.** Harvey, A.R.; Johnson, R.W.; Morrison, M.E. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1222-1225(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The authors have fabricated more than 3,000 high-quality, strip-wound, edge-cooled electromagnets for the PALADIN free-electron laser (FEL) experiment at the LLNL Advanced Test Accelerator (ATA). Close attention to tooling, semiautomated techniques, and selective unit grouping provided the means to manufacture these coils, from prototype to last production unit, within an 18-mo. time frame. In this paper, the authors discuss the evolution and implementation of the manufacturing techniques employed.

20275 **Development of the strong electromagnet wiggler.** Burns, M.J.; Deis, G.A.; Holmes, R.H.; Van Maren, R.D.; Halbach, K. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, L-628, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 978-981(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The Strong Electromagnet (SEM) wiggler is a permanent magnet-assisted electromagnet under development at the Lawrence Livermore National Laboratory (LLNL) as part of the Induction Linac Free-Electron-Laser (IFEL) program. This concept uses permanent magnets within the wiggler to provide a reverse bias flux in the iron and thus delay the onset of magnetic saturation. The electromagnet coils determine th4e wiggler field and operate at low current densities by virtue of their placement away from the midplane. The authors describe the design approach used and test data from a 7-period wiggler prototype that includes curved pole tips to provide wiggler-plane focusing.

20276 **A long electromagnetic wiggler for the paladin free-electron laser experiments.** Deis, G.A.; Harvey, A.R.; Parkison, C.D.; Prosnitz, D.; Rego, J.; Scharlemann, E.T.; Halbach, K. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1090-1093(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The authors have designed, built, and tested a 25.6-m-long wiggler for a free-electron-laser (FEL) experiment. It is a DC iron-core electromagnetic wiggler that incorporates a number of impor-

tant and unique facilities. Permanent magnets are used to suppress saturation in the iron and extend the linear operating range. Steering-free excitation allows real-time adjustment of the field taper without causing beam steering. Wiggle-plane focusing is produced by curved pole tips. The magnitude of random pole-to-pole field errors is minimized by a mechanical design concept that reduces tolerance stackup in critical locations. To date, the authors have tested 15 m of this wiggler, and their measurements have shown exceptionally low levels of random errors.

20277 **Electromagnetic wiggler technology development at the Lawrence Livermore National Laboratory.** Deis, G.A.; Burns, M.J.; Christensen, T.C.; Coffield, F.E.; Kulke, B.; Pronsitz, D.; Scharlemann, E.T.; Halback, K. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 986-989(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

As a part of the program at the Lawrence Livermore National Laboratory (LLNL) in induction-linac free-electron laser (IFEL) research, the authors are conducting a variety of activities addressing the unique requirements imposed on IFEL wiggler systems. They are actively developing improved DC iron-core electromagnetic wiggler designs to attain higher peak fields, greater tunability, and lower random error levels. They are pursuing specialized control systems, such as magnetic-field and beam-position controllers, which can relax requirements on the wiggler itself. They are also pursuing basic studies to establish the effect of radiation on permanent magnets.

20278 **Progress in single quantum well structures for high power laser device applications.** Waters, R.G.; Tihanyi, P.L.; Hill, D.S.; Soltz, B.A. pp 203-209 of High power laser diodes and applications; Proceedings of the Meeting, Los Angeles, CA, Jan. 14, 15, 1988. Figueroa, L. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). (CONF-8801114—).

From High power laser diodes and applications; Los Angeles, CA, USA (14 Jan 1988).

Recent advances made toward performance optimization of (Al)GaAs quantum well lasers are described. Topics covered include: laser reliability for broad-area devices emitting less than 300 mW and its relation to the epitaxial structure and operating current density; parametric crystal growth studies and the implications for device efficiency; realization of 57 percent cw power conversion efficiency in an oxide-defined device; progress in dry-etching technology including array fabrication and development of device-quality laser facets suitable for integration. Finally, work in the high-power regime is discussed. This includes broad-area, single-emitter lasers emitting 6W cw. 12 references.

20279 **Free electron lasers: Proceedings.** Sprangle, P.; Tang, C.M.; Walsh, J. (eds.). Amsterdam, Netherlands; North-Holland Physics Publishing (1988). 640p. (CONF-8709110—). Elsevier Science Publishing Co. Inc., 52 Vanderbilt Avenue, New York, NY 10017. Order Number TI89006979/JAW. Contract FG05-87ER13756.

From 9. international free-electron laser conference; Williamsburg, VA, USA (14 Sep 1987).

The Ninth International Free Electron Laser Conference held 14-18 September 1987 in Williamsburg, Virginia, provided an up-to-date account of free electron laser (FEL) physics and covered the full spectrum of experimental, theoretical and technological issues. Papers discussing FEL experiments around the world, completed, in progress or in the planning stages, were presented. Highlights of the Conference included the presentation by Dr. R. Phillips on the History of the Ubitron. The ubitron is an FEL operating at low beam voltages with an axial guide magnetic field. He described some of his experimental research on the ubitron (funded by the US Army and Air Force from 1957 to 1964), which produced record power levels in the 10 cm to 5 mm regime. Another highlight was the first presentations of experimental verifications of optical guiding in open resonators as well as in waveguide structures. The three-dimensional theories of FELs indicate that this guiding can improve the performance of the device. Experimental verification of optical guiding was reported by three groups: Stanford University (Stanford Photon Research Laboratory), Massachusetts Institute of Technology and Columbia University.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 19562, 19586, 19600, 19842, 20212, 20330, 21451

20280 **(AD-A—201102/1/XAB) Turbulent boundary layer on a cylinder in axial flow.** Lueptow, R.M. (Naval Underwater Systems Center, New London, CT (USA). New London Lab.). 29 Sep 1988. 66p. (NUSC-TR—8389). NTIS, PC A04/MF A01.

This report reviews research on the turbulent boundary layer that develops on a cylinder in axial flow. Experimental results indicate that the transverse curvature results in a higher coefficient of friction and a fuller velocity profile than for a planar boundary layer. However, appropriate scaling laws and nondimensional scaling parameters are still elusive. The few turbulence measurements such as Reynolds stress and intermittency that are available for a cylindrical boundary layer suggest that the distribution of turbulent quantities in the boundary layer is somewhat different from a planar boundary layer, particularly as the boundary layer becomes thick compared to the radius of the cylinder. This is most likely a result of the tendency for a cylindrical boundary layer to become wake-like as the cylinder becomes very small. Measurements of turbulence intensity and detection of turbulence-generating events in a cylindrical boundary layer suggest that the mechanism for the production of turbulence near the wall is similar to that for other wall-bounded flows. However, there is experimental evidence that the outer flow interacts with the near-wall flow to modify the generation of turbulence. Suggestions for further work include more comprehensive and sophisticated measurements of turbulent quantities in cylindrical boundary layers as well as computational modeling.

20281 **(CONF-8810155—43) Two-phase flow characteristic of inverted bubbly, slug and annular flow in post-critical heat flux region.** Ishii, M.; Denten, J.P. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007384/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Inverted annular flow can be visualized as a liquid jet-like core surrounded by a vapor annulus. While many analytical and experimental studies of heat transfer in this regime have been performed, there is very little understanding of the basic hydrodynamics of the post-CHF flow field. However, a recent experimental study was done that was able to successfully investigate the effects of various steady-state inlet flow parameters on the post-CHF hydrodynamics of the film boiling of a single phase liquid jet. This study was carried out by means of a visual photographic analysis of an idealized single phase core inverted annular flow initial geometry (single phase liquid jet core surrounded by a coaxial annulus of gas). In order to extend this study, a subsequent flow visualization of an idealized two-phase core inverted annular flow geometry (two-phase central jet core, surrounded by a coaxial annulus of gas) was carried out. The objective of this second experimental study was to investigate the effect of steady-state inlet, pre-CHF two-phase jet core parameters on the hydrodynamics of the post-CHF flow field. In actual film boiling situations, two-phase flows with net positive qualities at the CHF point are encountered. Thus, the focus of the present experimental study was on the inverted bubbly, slug, and annular flow fields in the post dryout film boiling region. Observed post dryout hydrodynamic behavior is reported. A correlation for the axial extent of the transition flow pattern between inverted annular and dispersed droplet flow (the agitated regime) is developed. It is shown to depend strongly on inlet jet core parameters and jet void fraction at the dryout point. 45 refs., 9 figs., 4 tabs.

20282 **(FRNC-TH—3388) Analysis of the steady state and transient operation of a multistaged fluidized bed gas-solid heat exchanger.** Bataille, D. (Institut National Polytechnique, 31 - Toulouse (France); Universite de Technologie de Compiegne, 60 (France)). 1986. 224p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756403/JAW.

This work consists in the analysis of the performance of a four stages fluidized bed for the heat exchange between hot sand and cold air circulating counter-currently and continuously. The analysis concerns both the steady-state and the dynamic regimes for different gas and solid flow rates, solids inlet temperature (400-1070/sup 0/C) and solids granulometry (415-620μm). The quantification of the heat exchanger performances is based on two criteria: - an overall transfer efficiency which permits a definition of the optimal operation by comparing the inlet and outlet temperature levels of the two phases: - a thermal yield which quantifies the actual exchanger operation compared to the adiabatic functioning. The experiments have led to the following points: - the exchanger performances are mainly influenced by the ratio of the heat capacities of the gas and solids phases and the solids inlet temperature: - they decrease when this temperature increases beyond 600/sup 0/C due to the increase in the thermal loss and the radiatif heat transfer between the stages. The temperatures of the gas distributors are different from those of the corresponding stages. A model of the exchanger behaviour in the steady state regime, based on the thermal equilibrium between the gas and the solids in each stage has been developed. It takes into account thermal loss, radiatif exchanges between the stages and temperature differences between the distributors and the stages. The predictions are in good agreement with the experimental data. The study of the dynamic behaviour of the exchanger in response to changes in the gas and solid flow rates shows the duality between the hydrodynamic phenomena and the thermal phenomena. A dynamic model of the exchanger, derived from the steady-state model which takes into account the hydrodynamic effects has been developed and successfully compared with the experimental data.

20283 **(N—89-13788) Thermal effects in two-phase flow through face seals. Ph.D. Thesis.** Basu, P. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). May 1988. 166p. (NASA-CR—180962; NAS—1.26:180962). NTIS, PC A08/MF A01.

When liquid is sealed at high temperature, it flashes inside the seal due to pressure drop and/or viscous heat dissipation. Two-phase seals generally exhibit more erratic behavior than their single phase counterparts. Thermal effects, which are often neglected in single phase seal analyses, play an important role in determining seal behavior under two-phase operation. It is necessary to consider the heat generation due to viscous shear, conduction into the seal rings and convection with the leakage flow. Analytical models developed work reasonably well at the two extremes - for low leakage rates when convection is neglected and for higher leakage rates when conduction is neglected. A preliminary model, known as the Film Coefficient Model, is presented which considers conduction and convection both, and allows continuous boiling over an extended region unlike the previous low-leakage rate model which neglects convection and always forces a discrete boiling interface. Another simplified, semi-analytical model, based on the assumption of isothermal conditions along the seal interafce, has been developed for low leakage rates. The Film Coefficient Model may be used for more accurate and realistic description.

20284 **(N—89-14418) Heat flux measurements.** Liebert, C.H.; Weikle, D.H. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1989. 14p. (NASA-TM—101428; E—4530; NAS—1.15:101428; CONF-890612—). NTIS, PC A03/MF A01.

From 34. international gas turbine and aeroengine congress and exposition; Toronto, Canada (4 Jun 1989).

A new automated, computer controlled heat flux measurement facility is described. Continuous transient and steady-state surface heat flux values varying from about 0.3 to 6 MW/sq m over a temperature range of 100 to 1200 K can be obtained in the facility. An application of this facility is the development of heat flux gauges for continuous fast transient surface heat flux measurement on turbine blades operating in space shuttle main engine turbopumps. The facility is useful for durability testing at fast temperature transients.

20285 **(N—89-14452) Role of thermal and lubricant boundary layers in the transient thermal analysis of spur gears.** El-Bayoumy, L.E.; Akin, L.S.; Townsend, D.P.; Choy, F.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1989. 17p. (NASA-TM—101435; E—4413; NAS—1.15:101435; AVSCOM-TR—88-C-032; CONF-8904122—). NTIS, PC A03/MF A01.

From 5. international power transmission and gearing conference; Chicago, IL, USA (25 Apr 1989).

An improved convection heat-transfer model has been developed for the prediction of the transient tooth surface temperature of spur gears. The dissipative quality of the lubricating fluid is shown to be limited to the capacity extent of the thermal boundary layer. This phenomenon can be of significance in the determination of the thermal limit of gears accelerating to the point where gear scoring occurs. Steady-state temperature prediction is improved considerably through the use of a variable integration time step that substantially reduces computer time. Computer-generated plots of temperature contours enable the user to animate the propagation of the thermal wave as the gears come into and out of contact, thus contributing to better understanding of this complex problem. This model has a much better capability at predicting gear-tooth temperatures than previous models.

20286 **(OEFZS—4478) Dynamics of heat transfer at a turbulent pipe flow. Part 5.** Schmidl, H. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Nov 1988. 59p. (In German). (EA—326/88). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88706122/JAW.

The temperature distribution of a turbulent pipe flow will be described at a system of differential equations. With changing several parameters these equations are solved. 10 refs., 10 figs., 3 tabs.

20287 **(PSI—20) PIREX II. Sample cooling and temperature control, an entrance region affected heat transfer problem.** Huggenberger, M.; Noethiger, H. (Paul Scherrer Institut, Villigen (Switzerland)). (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Nov 1988. 50p. (In German). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706123/JAW.

In the proton irradiation experiment PIREX II, for simulating radiation damage in candidate fusion reactor first-wall materials, cooling and temperature control of the highly heat-loaded test samples represents a key problem. In the geometrically complex test region, the convective heat transfer is affected by hydrodynamic and thermal entrance effects. Therefore, an experimental investigation in an electrically heated, air cooled test section, has been carried out, firstly, to successfully demonstrate the PIREX sample cooling concept, and secondly, to investigate the axial distribution of the heat transfer coefficient over the sample test region. Based on these measurements, correlations were developed to predict the PIREX sample temperatures, as a fundamental requirement for finally controlling them in the PIREX-helium loop. (author) 11 refs., 40 figs., 3 tabs.

20288 **(RISO-M—2758) Development of a computer model for stationary turbulent 3-D gas-particle flows. Characteristic parameters of gas-particle flow.** Dall, H. (Risoe National Lab., Roskilde (Denmark)). Dec 1988. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757060/JAW.

The main parameters governing the particle behaviour in turbulent gas-particle flows are investigated and the Lagrangian and Eulerian modelling approaches are reviewed. With respect to the modelling of pulverised coal fired furnaces it is concluded that particle-particle interactions are of minor importance and gas-turbulence of major importance and that two-way gas-particle interaction modelling is to be preferred. Of the two modelling approaches the Lagrangian is found preferable due to its supreme ability to

handle size distributed particles and due to the more physical way particle dispersion can be modelled. (author) 5 ills., 42 refs.

20289 **(RISO-M—2759) Development of a computer model for stationary turbulent 3-D gas-particle flows. PAFCA, PArticle Flow CAlculations, computer-program description.** Astrup, P. (Risoe National Lab., Roskilde (Denmark)). Dec 1988. 27p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757061/JAW.

PAFCA is a programme (FORTRAN-77) doing Lagrangian tracking of particles through a 3-D flow domain built of irregular formed boxes (cells) and with specified gas flow and turbulence fields. PAFCA has been made as part of the EFP-project "EFP-85, EM-Journal no. 1433/85-10; Development of a Computer Model for Stationary Turbulent 3-D Gas-Particle FLows" (EFP meaning research project funded by the Danish minister of energy), and works together with the gas flow programme TUFCA (TUrbulent Flow CAlgulations) developed within the same project (ref. 5). The programme accounts for gravity and aerodynamic forces and models the influence of the turbulence through a stochastic fluctuation overlaying the specified mean gas velocity. The particles can be specified to follow a log-norm size distribution or to be monosize, and a number density distribution as well as a distribution of mean velocities and rms velocity fluctuations can be specified for the inlet. The programme calculates the steady state volumetric concentrations of particles and the momentum exchange with the gas, the latter to allow two way coupling between gas flow and particle flow calculations. For comparison to experiments particle mean velocities and rms velocity fluctuations are also calculated.

20290 **Transfer functions for efficient calculation of multidimensional transient heat transfer.** Seem, J.E.; Klein, S.A.; Beckman, W.A.; Mitchell, J.W. (Solar Energy Laboratory, University of Wisconsin—Madison, Madison, WI 53706). *Journal of Heat Transfer;* **111**: No. 1, 5-12(Feb 1989).

Finite difference or finite element methods reduce transient multidimensional heat transfer problems into a set of first-order differential equations when thermal physical properties are time invariant and the heat transfer processes are linear. This paper presents a method for determining the exact solution to a set of first-order differential equations when the inputs are modeled by a continuous, piecewise linear curve. For long-time solutions, the method presented is more efficient than Euler, Crank-Nicolson, or other classical techniques.

20291 **Performance of a three-phase, spray-column, direct-contact heat exchanger.** C-cedillaoban, T.; Boehm, R. (Mechanical and Industrial Engineering Department, University of Utah, Salt Lake City, UT 84112). *Journal of Heat Transfer;* **111**: No. 1, 166-172(Feb 1989).

A numerical model of a three-phase, direct-contact, spray-column heat exchanger has been developed. This model has been used to calculate performance information about this type of device and to compare, where possible, to experiments. General equations are defined for distance up the column using a physically based model for the local heat transfer. This model has been used to investigate a number of characteristics of these devices, such as temperature and holdup distributions through the column. A new formulation is given for a mixed, time-averaged temperature that may be representative of measurements taken with temperature transducers in direct-contact heat exchangers. Little has been given in the literature about quantitative variations of performance as a function of the key independent variables, and information on these aspects is presented here. Although the results presented are for a specific geometry (0.61 m diameter, 3 m active column height, evaporating pentane in 85° C water), the variations shown can give insights generally into the factors affecting performance in these devices. In virtually all cases examined here, extremely good comparisons are shown between predictions and measurements. Conclusions are drawn about the applicability of the model and the important effects demonstrated.

4205 Materials Testing

REFER ALSO TO CITATION(S) 19309, 19415, 19571, 19572, 19575, 19576, 19582, 19583, 19584, 19606, 19644, 19645, 19889, 19890, 19891, 19893, 19986, 19987

20292 **(INIS-BR—1414) X-ray industrial systems highly stabilized and its application in composite material in aeronautics industry.** Bohnsack, G. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 17p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705737/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

The application of high-stability X-ray industrial systems is shown. Its advantages in relation of other X-ray systems and its aplications in aeronautics industry are described. (C.M.).

20293 **(INIS-BR—1415) Compton scattering of gamma rays in nondestructive testing.** Anjos, M.J. dos; Lopes, R.T. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 16p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705738/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

A system constituted of a Cesium 137 source with activity of 7,4 x 10/sup 10/ Bq, whose gamma rays energy is 662 KeV and a NaI (Tl) of 50 x 50 mm as surface inspection techniques is presented. The physical basic principle is the gamma radiation interaction with matter, where the predominant interaction is the comption scattering. The scattering angle chose is 90/sup 0/. Aluminium blocks, are used as sample with defects in surfaces of several diameters. Defects with measurements higher than 1,6 mm, were detected. (C.M.).

20294 **(INIS-BR—1416) Experimental determination of ideal concrete density used for applications in bunkers.** Bitelli, T.; Coelho, G.M. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo (Brazil); Tecnorte Engenharia da Qualidade Ltda, Sao Paulo (Brazil)). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 9p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705739/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

Comparisons between barite concrete of different densities and exactly equal measures, subjected to gamma irradiation of /sup 192/Ir source, with changeless measure of geometry are presented. The experimental results and the applied statistics with 95% of trust, confirm that the barite added supplies a significant increase of irradiation attenuation. (C.M.).

20295 **(INIS-GB—171) Management Advisory Committee of the Inspection Validation Centre - fifth report.** (UKAEA Northern Research Labs., Risley (UK). Inspection Validation Centre). Jul 1988. 4p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705522/JAW.

The Management Advisory Committee of the Inspection Validation Centre (IVC/MAC) was set up by the Chairman of the UKAEA early in 1983 with terms of reference to review the policy, scope, procedure and operation of the Inspection Validation Centre, to supervise its operation and to advise and report to the UKAEA appropriately. The Inspection Validation Centre (IVC) has been established at the UKAEA Northern Research Laboratories, Risley for the purpose of validating the procedures, equipment and personnel proposed by the CEGB for use in the ultrasonic inspection at various stages of the fabrication, erection and operation of the CEGB's PWR reactor pressure vessel and such other components as are identified by the CEGB. This report, for 1987/8, states that the IVC has continued to make progress in the provision of the validation services as specified.

20296 **(INIS-mf—11894) Fundamentals of a method for nondestructive determination of flaw locations, shapes and dimensions in welded seams using radiometric measurements.** Wuensch, W. (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.)). 1986. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756954/JAW.

Technisch-wissenschaftliche Berichte der Staatlichen Materialpruefungsanstalt, Universitaet Stuttgart.; no. 86-02.

By using collimated Ir-192 gamma radiation in connection with a combination of NaJ scintillator and photodiode or photomultiplier, there is an exponential relation within the framework of measurement accuracy between the radiated steel wall thickness D in the range 0 ... 60 mm and the output signal of the radiation receiver. A theoretical value for the extinction coefficient was determined. Because of the exponential relation between radiated wall thickness and detector signal, a special evaluation amplifier was developed, with which changes in the wall thickness can be directly measured and thus the thickness profile of the samples can be obtained. A stable system of coordinates is determined and the cross section of the samples contained in it are reconstructed with the help of a thickness profile and two radiation profiles at an angle of 90/sup 0/ and which are won without evaluation amplifier. Defects in the cross section of the samples can be reconstructed according to form, size and position by means of other radiation profiles won under different radiation directions.

20297 **(INIS-mf—11896) Safety and reliability of pressure components with special emphasis on advanced methods of NDT. Vol. 1. Nondestructive testing.** (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.)). 1986. 478p. (In German, English). (CONF-8610283—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW.

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

24 papers discuss various methods for nondestructive testing of materials, e.g. eddy current measurement, EMAG analyser, tomography, ultrasound, holographic interferometry, and optical sound field camera. Special consideration is given to mathematical programmes and tests allowing to determine fracture-mechanical parameters and to assess cracks in various components, system parts and individual specimens both in pressurized systems and NPP systems. Studies focus on weld seams and adjacent areas.

20298 (INIS-mf—11896, pp 1.1-1.23) **On-line-NDT-instrumentation for thermal shock trials at a HDR pressure vessel nozzle.** Brinette, R.; Dobmann, G.; Deuster, G.; Katzenmeier, G. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Tests were run on feedwater nozzles under pressurized water conditions. The course of all detected SE signals for two parallel measuring systems reveals a supraproportional signal of crack expansion relative to the increasing crack surface which is due to the adding up of noises of crack propagation and crack friction. Correlation approaches prove sound emission to provide clear information relative to crack strain or crack growth.

20299 (INIS-mf—11896, pp 5.1-5.15) **Status of advanced UT systems for the nuclear industry.** Behravesh, M.; Avioli, M.; Dau, G.; Liu, S.N. (Electric Power Research Inst., Inc., Palo Alto, CA (USA)). 1986. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Advanced systems were developed with the goals of reduced radiation exposure and increased reliability. These systems use scanners for high-density coverage of components, and since some of them are mechanized and remotely controllable, radiation exposures to personnel can greatly be reduced. The AMAPs is a mechanized scanner developed by EPRI. Digital recording and processing of data facilitate repetition of stored scan patterns, data logging for data review, and application of signal processing techniques for noise reduction.

20300 (INIS-mf—11896, pp 6.1-6.23) **Evaluation of SCC defects of steel pipe using high-energy X-ray CT scanner.** Miyoshi, Shigeru; Tanimoto, Yoshinori; Uyama, Kiichiro; Tsujii, Osamu. (Japan Power Engineering and Investigation Corp., Tokyo. Research and Investigation Dept.; Toshiba Corp., Fuchu (Japan). Fuchu Works). 1986. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The X-ray computed CT scanner capable of producing sharp tomograms was expected to become practical and revolutional means in nondestructive inspection in industrial field. In Japan, the development of Linac X-ray CT scanner is under way for the inspection of SCC in weld of the nuclear power plant. For development of the Linac-CT, the preliminary experiments for the inspection of SCC artificial defects were performed using 420 kVp industrial X-ray CT scanner (TOSCANER 4200) which had been developed by Toshiba Corporation. This paper includes the background of this program and the summary of preliminary experiments for X-ray CT.

20301 (INIS-mf—11896, pp 7.1-7.21) **Neutron tomography scanner for application in nondestructive testing.** Pfister, G.; Maier, P.; Hehn, G.; Stier, G.; Kegreiss, W. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Computer simulations allowed to confirm the excellent suitability of fast neutrons with energies up to several MeV for the examination of thick-walled specimens and dense materials (e.g. metals). Based on these simulations, CT measurements were performed on different neutron sources (fast and thermal neutrons). The measurements allowed to achieve a local resolution of about 0.1 mm and a contrast resolution of about 5%.

20302 (INIS-mf—11896, pp 10.1-10.14) **Profile- and deformation-measurements with high axial resolution using the acoustical holography.** Crostack, H.A.; Roye, W. (Dortmund Univ. (Germany, F.R.). Fachgebiet Qualitaetskontrolle). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

An improved acoustic-holographic reconstruction algorithm allows three-dimensional reflector imaging with ultrasound combined with an axial resolution which is far below a wave length. This allows for the first time to measure deformations of internal material defects due to thermal or mechanical stress and, thus, to assess the real hazard induced by a defect. Acoustic holography for contours and deformations requires little computer memory for measured values and data processing; hence a minicomputer would suffice which is a further benefit in terms of mobility and profitability of a measurement device.

20303 (INIS-mf—11896, pp 13.1-13.21) **Crack-depth measurement at fracture mechanics specimens by evaluating the dynamics of the US-signal.** Steinmill, H.; Kockelmann, H. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Fracture-mechanics parameters and materials characteristics are established on compact traction specimens CT 10 to CT 500. A major step in specimen production is the introduction of a fatigue crack starting from a mechanically produced notch. The authors briefly discuss the problems of measuring the crack depth by means of optic scanning and parallel US run-time method with evaluation of signal dynamics.

20304 (INIS-mf—11896, pp 14.1-14.18) **Crack-depth measurement methods applied in plant-monitoring.** Hess, A.; Thoma, C. (Thyssen Stahl A.G., Duisburg (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

For years, the Thyssen Stahl AG have committed research activities to the further development of nondestructive testing procedures which allow to achieve maximum accuracy in crack depth determination under rough operating conditions. These methods are mainly the potential probe method with direct current and the ultrasound crack-tip method. Corresponding devices are portable and easy to operate.

20305 (INIS-mf—11896, pp 15.1-15.12) **Detection and description of surface breaking cracks by means of optical sound field visualization.** Crostack, H.A.; Krueger, A. (Dortmund Univ. (Germany, F.R.). Fachgebiet Qualitaetskontrolle). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The authors present an ultrasound testing method for surface-breaking cracks in components. The method is based on large-area imaging of ultrasound by means of an optical receiver system. The receiver system is based on the principle of holographic interferometry. Application of double exposure technique using a double pulse laser and of sensitivity boosting measures allowed to construct a holographic sound field camera (sensitivity threshold: 0.2 nm) which allows large-area sound detection (in the square meter range) without requiring the usual methods for vibrational insulation in contrast to all the other optical interferometric and holographic techniques.

20306 (INIS-mf—11896, pp 16.1-16.17) **In the field experiences with the LSAFT-prototype.** Schmitz, V.; Mueller, W.; Schaefer, G. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The method is used to detect and measure macroscopic defects in base material, weld flanks or filler which originated during manufacture or operational loads. Its high analysis capacity and lateral and axial resolution allow to resolve many insignificant small defects which simulate a single large and nonacceptable defect. The authors demonstrate its analysis capacity by means of a component with internal crack, a PISC test specimen, some turbine shafts and a large tank.

20307 (INIS-mf—11896, pp 17.1-17.26) **Application of the ultrasonic tomography on turbines and rotor shafts.** Wuestenberg, H.; Erhard, G.; Schenk, G.; Montag, H.; Klanke, H.P.; Austel, W. (Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.); Schmiedewerke Krupp-Kloeckner G.m.b.H., Osnabrueck (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The results of ultrasound echo tomography reveal this method to be highly suitable for ultrasonic testing of heavy forged parts. Resolution is sufficient to image all desired details. Physically, it is restricted to an order of magnitude of 2-3 mm owing to long sound paths; practically, it is limited to 3-5 mm. This is not due to the band width of the signals used but to the accuracy of probe head positioning, sound velocity determination and sound field control.

20308 (INIS-mf—11896, pp 19.1-19.12) **Experience with a versatile ALOK-ultrasonic equipment.** Dressler, K.; Werden, B. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Initial applications of the ALOK test system of RWTUeV show the combination of an advanced ultrasonic device with a flexibel use manipulator to need further optimization for use in a mobile system. Manipulators can negotiate plane and curved surfaces of a diameter larger than 200 mm.

20309 (INIS-mf—11896, pp 20.1-20.16) **Evidence of performance for phased array/ALOK-inspection technique.** Bohn, H.; Kroening, M.; Rathgeb, W.; Gebhardt, W.; Kappes, W.; Barbian, O.A. (Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.); Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.); Salzgitter Industriebau G.m.b.H. (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Phased-array probes combined with the ALOK method give an US test system which results in major improvements of automated ultrasonic testing of pressure vessels. The authors discuss the improvements in test execution, defect detection and interpretation by means of tandem defects and defect detection in fault displays.

20310 (INIS-mf—11896, pp 21.1-21.25) **Ultrasonic testing of components and plant at temperatures up to 250/sup 0/C.** Matthies, K.; Neumann, E.; Mrasek, H. (Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.). Fachgruppe 6.2 Zerstoerungsfreie Pruefung). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The design principle of hot probes is based on avoiding any rigid connections; hence, the transducers and adapter foils are squeezed on to the wedge; in the case of SEL probes, the wedges are held in place by pins in the casings. The base of transceiver transversal-wave probes have a concave configuration. Special emphasis is placed on wave resistance transformation between transducer and wedge.

20311 (INIS-mf—11896, pp 22.1-22.24) **Prototyoe EMAT system for tube inspection with guided ultrasonic waves.** Boettger, W.; Schneider, H.; Weingarten, W. (Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

In contrast to unguided ultrasound, guided waves in tubes are used for testing which involves the tube tested to pass through

two transducer systems and to be stopped in any axial position. The transducer systems emit the tube wave pulses in the opposite direction. Studies showed the feasibility of NDT tube testing using guided waves which are electrodynamically excited.

20312 (INIS-mf—11896, pp 23.1-23.18) **Crack depth measurement in stainless steel pipes - methods and reliability.** Dalichow, M.; Heumueller, R.; Kroening, M.; Schmid, R. (Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

Imaging US reconstruction methods (55/sup 0/ SEL and ADEPT 60/sup 0/ for crack tip detection and 48/sup 0/ ET for crack detection and amplitude evaluation) will supply reliable results in austenitic pipings, too. Based on known specific crack types, manual crack depth measurement can be standardized within the framework of findings analyses.

20313 (INIS-mf—11896, pp 24.1-24.23) **On the ultrasonic inspection of austenitic welds.** Wessels, J. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). 1986. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756955/JAW. (CONF-8610283—).

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

This US inspection method has not been standardized in approach yet. Techniques of general application could be based on an approach as is demonstrated by the author for sheets and plates with welds. The author presents methods for producing welds which will facilitate testing.

20314 **(INIS-mf—11897) Safety and reliability of pressure components with special emphasis on advanced methods of NDT. Vol. 2. Strength and safety.** (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.)). 1986. 325p. (In German, English). (CONF-8610283—). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756956/JAW.

From 12. MPA seminar on safety and reliability of pressure components with special emphasis on nuclear technology; Stuttgart, F.R. Germany (9 Oct 1986).

The 12 papers discuss topics of strength and safety in the field of materials technology and engineering. Conclusions for NPP component safety and materials are drawn. Measurements and studies relate to fracture mechanics methods (oscillation, burst, material strength, characteristics). The dynamic analysis of the behaviour of large test specimens, the influence of load velocity on crack resistance curve and the development of forged parts from austenitic steel for fast breeder reactors are presented.

20315 **(INIS-mf—11899) Supervision of extensive loading experiments (pressure tests, cyclic loads) on an interim storage container, type ZB 2, using acoustic emission analysis. Technical report.** Gertkemper, H.J.; Knoch, P. (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.); Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)). May 1987. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756958/JAW.

In the shelter of the Mannheim large power station, loading tests were carried out on a thick-walled vessel with 114 artificially produced realistic defects according to a given number of load tests (pressure tests, thermal durability, cyclic loads, hot and cold). Besides the simple test procedure, almost all test phases were monitored by TRP. Inspite of the knowledge about where the defects had been incorporated, the vessel was globally equipped with a maximum of 12 probes for test phases at low temperatures (40-50/sup 0/C) and with 4 probes mounted on waveguides for phases at high temperatures (240 or 288/sup 0/C). With regard to the cyclic tests at low temperatures (on the whole 14170 cold cycles were effected) the TR measurements proved that defects from a size of 50 to 100 mm length and 20 to 30 mm depth and more can be detected by TR with high probability even with global instrumentation. As for cyclic loading the TR-probe showed satisfactory to good probabilites for defect detection; unsatisfactory probabilites, however, were achieved in pressure tests with a practice-oriented pressure increase rate and relatively small, non-growing defects in tenacious base material.

20316 (N—89-13642, pp 139-153) **Determining bonding, thickness, and density via thermal wave impedance NDE.** Green, D.R. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

Bonding, density, and thickness of coatings have a vital effect on their performance in many applications. Pioneering development work on thermal wave nondestructive evaluation (NDE) methods during the past 25 years has resulted in an array of useful techniques for performing bonding, density, and thickness measurements in a practical shop environment. The most useful thermal wave methods for this purpose are based on thermal wave surface impedance measurement or scanning. A pulse of heat from either a thermal transducer or a hot gas pulse is projected onto the surface, and the resulting temperature response is analyzed to unfold the bonding, density, and thickness of the coating. An advanced emissivity independent infrared method was applied to detect the temperature response. These methods were recently completely computerized and can automatically provide information on coating quality in near real-time using the proper equipment. Complex shapes such as turbine blades can be scanned. Microscopic inhomogeneities such as microstructural differences and small, normal, isolated voids do not cause problems but are seen as slight differences in the bulk thermal properties. Test objects with rough surfaces can be effectively nondestructively evaluated using proper thermal surface impedance methods. Some of the basic principles involved, as well as metallographic results illustrating the ability of the thermal wave surface impedance method to detect natural nonbonds under a two-layer thermally sprayed coating, will be presented.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 19265, 19553, 19615, 19701, 20105, 20242, 20452, 20455

20317 **(LBL—25167) Evaluation of fast voltage discriminators in the picosecond time range.** Kolbe, W.F.; Turko, B.T.; Smith, R.C. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098;W-7405-ENG-36. 7p. (CONF-881103—40). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007134/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

An automated system for the evaluation of fast risetime voltage discriminators is described. A high-performance time digitizer is used to determine the elapsed time between the generation of a test pulse and the response of the discriminator under test. The measurement is repeated for a series of discriminator threshold levels generated by a digital-to-analog converter and the results compared to a photograph of the leading edge of the pulse obtained with a sampling oscilloscope. To obtain high accuracy, an average of several thousand individual digitizations is used in each measurement to reduce the uncertainty to a maximum of +-3 ps. The measurement system is used with a test fixture to evaluate the performance of a number of tunnel diodes and in preliminary measurements of a prototype discriminator of new design. 2 refs., 9 figs.

20318 **(LBL—25169) Front end electronics for the jet drift chamber.** Lo, C.C.; Olson, S.; Bistirlich, J. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 6p. (CONF-881103—55). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007663/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

The Jet Drift Chamber employs a charge division readout scheme which requires two amplifiers per sense wire. Since there are 690 sense wires, 1380 amplifiers are needed. It follows that each end cap must accommodate 690 amplifiers which makes packaging and cooling critical problems. As a result, 30 six-layer surface mount boards each containing 24 (23 used) channels of amplifiers have been made. Each amplifier could accept up to 2 pC of charge and could provide a linear differential output of {+-} 300 mV which is used to drive a twisted pair transmission line up to 70' in length. The power dissipation of each board is 1.5 W. 4 refs., 7 figs.

20319 **(SAND—88-2526C) Effect of winding tension/space factor and edge margin on performance of a perfluorocarbon liquid/plastic film capacitor.** Harris, J.O. Jr.; Foster, J.C.; DeLancey, R.W. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 6p. (CONF-890368—1). NTIS, PC A02 - OSTI. Order Number DE89007584/JAW.

From Capacitor and resistor technology symposium; Orlando, FL, USA (13 Mar 1989).

Data is presented showing the average space favor (the ratio of the space between foil and film layers expressed as a percentage of the total dielectric film thickness) for test capacitor rolls as a function of winding tension, as well as the methodology of determining the space factor for cylindrical rolls. The variability of the space factor within capacitor rolls for each of the five candidate winding tensions is also presented. Capacitor performance, as measured by three destructive (D-test) methods, is then given for capacitors with rolls fabricated as selected space factors (winding tensions) for two subgroups of units with edge margin as the second variable. These results indicate that performance can be greatly enhanced by careful selection of these two design parameters, i.e. space factor and edge margin. Finally, a performance summary for the same capacitor is presented with the type of electroding system as the process variable. Details of this study were presented at the 1988 CARTS Europe conference. 5 refs., 5 figs., 1 tab.

20320 **Gas mixtures for spark gap closing switches.** Christophorou, L.G.; McCorkle, D.L.; Hunter, S.R. (to Dept. of Energy, Washington, DC). US Patent 4,792,724. 20 Dec 1988. Filed date 20 Feb 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a spark gap closing switch having two electrodes and disposed between the electrodes of the switch a gas mixture comprising a first gas component that attaches strongly to electrons at low energies, the attachment being exclusively nondissociative and decreasing with increasing gas temperature, and a second gas component that has low molecular weight, is nonreacting and increases the electron drift velocity within the switch.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 20324, 21560

20321 **(AFME—87-0041-2) Energetic up-grading of wood and wastes in industry.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1987. 105p. (In French). (CONF-870350—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756980/JAW.

From MEI 87: European technical symposium on energy management in industry; Paris, France (31 Mar 1987).

Different ways of up-grading refuse and wood for energy production are presented: incineration burners for plastic wastes, with energy recovery; combustion and methanic fermentation association for the up-grading of municipal wastes; a rapid pyrolysis process and its application to paper industry; new technologies the wood combustion and its industrial application; production of electricity from sugar-cane bagasse combustion.

20322 **(NP—9770280) Pilot study of an experimentally verified prognosis of the pollution exposure assessment for the planned waste incineration plant Bonn-Nord.** Jockel, W.; Kropp, L.; Lindackers, K.H.; Priebe, A. (Technischer Ueberwachungs-Verien Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz). 18 Mar 1985. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770280/JAW.

A pilot study has been made by the Technical Control Board Rhineland for assessing the pollution load to be expected from a planned waste incineration plant at Bonn-Nord, for a given area, with respect to the pollutants and their medium and long-term effects on various acceptors (soil and plants). The study has been restricted to the assessment of impacts of and on matter, whereas other nuisances such as noise, or vibrations, have been left out of consideration. The investigations covered an area of 4x4 kilometers in the region around Bonn, and have been carried out over a period of seven months in 1983 (predominantly in the summer season). Determination of the existing conditions in this area have been made in compliance with the provisions of the Clean Air Technical Code (TA Luft). In addition, and simultaneously, pollutant-effect measurements have been carried out, followed by assessments of the additional emissions and their effects in the area emanating from the planned waste incineration plant.

20323 **(VTT-TIED—888) Utilization of energy content of fiber board, paint, packaging and textile wastes.** Tirkkonen, T.; Laukkarinen, A.; Puustinen, H. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Kemian Lab.; Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). LVI-tekniikan Laboratorio). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Aug 1988. 40p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757110/JAW.

The composition of fiber board wastes, paint wastes, fibrous package wastes and textile wastes have been investigated in this research as well as the effects of composition of emissions formed during incineration of these wastes. The technical problems and demand of further research of combustion of the wastes have also been investigated.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 19215, 19216, 19217, 19552, 19707, 19910, 19911, 19912, 19913, 19914, 19915, 19916, 20003, 20004, 20005, 20070, 20209, 20284

20324 **(CONF-880215—7) Emissions reduction from MSW combustion systems using natural gas.** Fleming, D.K.; Khinkis, M.J.; Abbasi, H.A.; Linz, D.G.; Penterson, C.A. (Institute of Gas Technology, Chicago, IL (USA)). 1988. 30p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007174/JAW.

From Energy from biomass and wastes; New Orleans, LA, USA (15 Feb 1988).

A program has been initiated to assess the applicability of natural gas reburning for emissions reduction from MSW to energy systems. This paper presents the results of the first phase of this investigation---the evaluation of emissions data from a modern mass burn facility. At typical operating conditions of greater than 60% excess air, the carbon monoxide emissions are low---40 to 70 ppM (as corrected to 3% O_2). Variations in operating conditions have little impact upon the CO emissions; these effects were largely overshadowed by the long residence time above 1400{degree}F within the system. Similarly, the concentration of unburned hydrocarbons was also low---0 to 10 ppM. Conversely, the concentrations of NO/sub x/ were influenced by the mixing parameters within the system. At normal operating conditions, the NO/sub x/ production was approximately 300 ppM (3% O_2), or about 10% of the fuel-nitrogen was converted to NO/sub x/. Approximately 25% of this NO/sub x/ was produced at the grate; the remainder was generated in the overfire air zone and was a function of the quantity of air fed to this zone and the mixing parameters of this zone. Strategies have been developed for using natural gas a a reburning fuel. Based upon the combustion kinetics of the reburning process, it is believed that

NO/sub x/ emissions may be reduced substantially. Products of incomplete combustion, such as carbon monoxide and unburned hydrocarbons may also be reduced, because natural gas injection should improve system uniformity and stability in the lower furnace. 4 refs., 16 figs., 2 tabs.

20325 **(CONF-8711291—1) Combustion modifications for control of NO/sub x/ emissions from glass melting furnaces.** Abbasi, H.A.; Fleming, D.K. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 18p. OSTI - Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI89007166/JAW.

From 48. annual conference on glass problems; Urbana, IL, USA (10 Nov 1987).

This paper discusses the results of field tests using combustion modifications for control of NO/sub x/ emissions from glass melting furnaces. The techniques were initially developed on a pilot-scale glass tank simulator, resulting in generalized correlations between NO/sub x/ formation and port design and operating parameters. Two commercial container glass melting furnaces were tested {endash} a 150 tonne/day (165 t/day) endport furnace and a 225 tonne/day (250 t/day) sideport furnace. This paper reviews the generalized correlations, discusses the extent of their agreement with the field test data, and recommends direction for design and operation that should minimize NO/sub x/ production. 6 refs., 5 figs.

20326 (N—89-13642, pp 167-170) **Aluminum oxide barriers in MCrAlY superalloy systems.** Kreider, K.G. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

An investigation was made of sputtered aluminum oxide diffusion barriers to protect gas turbine engine blade and vane alloys from their coatings. MAR M200 + Hf coated with sputtered NiCoCrAlY and MAR M509 coated with sputtered FeCrAlY were obtained both with and without 1 and 2 micron sputtered Al2O3 barrier layers. Electron dispersive X-ray analysis was used to determine the concentration profiles of as-received and heat treated samples.

20327 (N—89-13642, pp 187-196) **High time service evaluation of thermal barrier coatings on the Rolls-Royce RB211 engine.** Toriz, F.C. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

One of the main concerns of airline operators for the use of thermal barrier coatings (TBC) in the turbine is that the coating will spall and cause a premature engine removal. Even though much cyclic data is available on TBCs, high time data is much harder and expensive to come by. The typical 150 h type test used to qualify hardware, or modifications, falls far short of the 5 to 10,000 hour experience desired. One way to obtain data demonstrating the longevity of TBCs is through a service evaluation program on a commercial engine. For a meaningful evaluation of the TBC system it must be applied to a component which operates in a typical hot end environment. In addition the component performance should not suffer if the coating is lost. For these reasons Rolls-Royce chose to coat the IP turbine nozzle guide vanes, and run these in an RB211 engine. Two ceramic top coats and several different bond coats were tested in a rainbow fashion on several engines. Three layer magnesium zirconate was used as a base line. Various yttria stabilized zirconia ceramics were used. Top MCrAlY bond coats were applied by various techniques. Some of the coated vanes have now accumulated ofer 5000 hours. The results are presented from the first sets with 2500 and 4200 hours of service respectively.

20328 (N—89-13642, pp 197-202) **Thermal barrier coatings for the space shuttle main engine turbine blades.** Bhat, B.N.; Gilmore, H.L.; Holmes, R.R. 1985. NTIS, PC A10/MF A01. (NASA-CP—10019; E—4425; NAS—1.55:10019; CONF-8505396—).

From Thermal barrier coatings workshop; Cleveland, OH, USA (21 May 1985).

The Space Shuttle Main Engine (SSME) turbopump turbine blades experience extremely severe thermal shocks during start-up and shut-down. For instance, the high pressure fuel turbopump turbine which burns liquid hydrogen operates at approximately 1500 F, but is shut down fuel rich with turbine blades quenced in liquid hydrogen. This thermal shock is a major contributor to blade cracking. The same thermal shock cause the protective ZrO2 thermal barrier coatings to spall or flake off, leaving only the NiCrAlY bond coating which provides only a minimum thermal protection. The turbine blades are therefore life limited to about 3000 sec for want of a good thermal barrier. A suitable thermal barrier coating (TBC) is being developed for the SSME turbine blades. Various TBCs developed for the gas turbine engines were tested in a specially built turbine blade tester. This tester subjects the coated blades to thermal and pressure cycles similar to those during actual operation of the turbine. The coatings were applied using a plasma spraying techniques both under atmospheric conditions and in vacuum. Results are presented. In general vacuum plasma sprayed coatings performed much better than those sprayed under atmospheric conditions. A 50 to 50 blend of Cr2O3 and NiCrAlY, vacuum plasma sprayed on SSME turbopump turbine blades appear to provide significant improvements in coating durability and thermal protection.

20329 **(NP—9770278) Low-NO/sub x/ pulverized coal firing system with furnace air staging; demonstration in the IAW power plant, Leiningerwerk unit 5. Final report.** Schranner, M.; Gillberg, G.; Schroeder, U.; Kaminski, P. (Isar-Amperwerke A.G., Muenchen (Germany, F.R.); Deutsche Babcock Werke A.G., Oberhausen (Germany, F.R.)). (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Isar-Amperwerke A.G., Muenchen (Germany, F.R.)). Jul 1988. 81p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770278/JAW.

Reducing the air-flow through the burners and admitting the remaining air through separate nozzles above the upper burner-level is an effective method of reducing the NO/sub x/-emission of pulverized coal fired boilers. The intention of the project was the development and demonstration of the in-furnace-air-staging concept. The objective of the project was achieved. Compared to conventional firing-concepts a substantial lower NO/sub x/-figure could be proved. Under suitable circumstances the technology of in-furnace-staging is also applicable to other pulverized coal fired boilers. (orig.) With 3 tabs., 33 figs.

20330 **(NP—9770283) Flow- and reaction profile as stabilization characteristics of swirl flames under the influence of internal recirculation flow fields. Final report.** (Karlsruhe Univ. (T.H.) (Germany, F.R.). Engler-Bunte-Institut Bereich 3 - Feuerungstechnik). Feb 1988. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE89770283/JAW.

The paper presents fundamental studies on swirled (supercritical) free jets and free jets diffusion flames which are defined as having a central reverse flow or recirculation flow. The studies comprised detailed investigations of the pressure and flow field and - in the case of swirl flames - the temperature and reaction field near the burner as a function of the technically relevant constructional parameters, eg. swirl coefficient, burner outlet geometry, and fuel supply. Further investigations focused on the ignition stability of the swirl flames, with particular regard to the structure of the internal recirculation zone and the conditions at the recirculation zone boundary: The excellent flame stability also at high fuel/air flow rates is explained in terms of intensive turbulent energy exchange between the recirculation zone and the main flow and as a result of the times of residue distribution in the stabilisation zone, for which the influence of the reaction kinetics on the quenching of the reaction is not fully explained as yet. Time-of-residue investigations may provide information on the system characteristics of the swirl flame. This may be useful in describing the turbulent flame velocity (well-stirred reactor characteristics, laminar flamelet, etc.) on the basis of turbulence data, in assessing the dynamic propertis of the flame when avoiding combustion chamber vibrations (dead time distribution), and in NO/sub x/ minimisation.

20331 (SAND—89-8442) **Workshop on mass, momentum, and energy exchange in combusting sprays: Droplet studies.** Sanders, B.R.; Bergan, N.E. (eds.). (Sandia National Labs., Livermore, CA (USA)). 1988. Contract AC04-76DR00789. 84p. (CONF-8803195—Summs.). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008322/JAW.

From Workshop on mass, momentum, and energy exchange in combusting sprays: droplet studies; Livermore, CA, USA (28 Mar 1988).

This report consists of an Executive Summary followed by Workshop Proceedings. The Executive Summary concisely states the motivation for the workshop, the workshop structure and a summary of findings and recommendations. A set of droplet research problems for experimental and computational/analytical studies are also recommended for consideration as "standard" problems for the droplet community. The Proceedings contains extended abstracts and presentation materials of invited theoretical and experimental overviews delivered at the workshop, and abstracts of presentations by six invited panel discussors. Also contained in the Proceedings are specific questions assigned to working groups and the written responses.

20332 (STU—85-5404, pp 83-88) **Corrosion/erosion of materials for fluidized bed combustion.** Haeggblom, E. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 15 Dec 1986. NTIS (US Sales Only), PC A19/MF A01. Order Number DE88757086/JAW. (CONF-8606347—).

From 10. Scandinavian corrosion congress - NKM 10; Stockholm, Sweden (2 Jun 1986).

Metallic specimens with and without plasma-sprayed ceramic coatings, have been exposed in an atmospheric fluidized bed combustor (AFBC). Uncooled materials were exposed in the bed and in the freeboard. Cooled materials were clamped upon the in-bed tubes. Cooled unalloyed and low alloyed pressure vessel steels have been heavily corroded and eroded, but 12Cr-1Mo steel have markedly better resistance. Uncooled Fe-Cr-Al alloys resisted the test in the freeboard with limited total attacks and no intergranular corrosion, while nickel base alloys were significantly more corroded. In the bed zone, type 347H performed well.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 19890, 20793, 20797, 20802

20333 (NRC/ACGR—NRCC28003TM41, pp 432) **Mechanical properties of multi-year sea ice.** Richter-Menge, J.A. 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON K1A OR6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1;$10 CAN. (CONF-8706378—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (1 Jun 1987).

Data on the mechanical properties of multi-year sea ice are necessary for developing Arctic structures and vessels that must be designed to withstand the impact of a multi-year ice pressure. A two-phase study that involved testing of over 500 multi-year ridge ice samples was designed and completed. The first phase included collecting samples of 10 different multi-year pressure ridges in the southern Beaufort Sea, developing a variety of test techniques, and performing 282 uniaxial compression, tension and confined compression tests on vertically cored samples. The second phase also included a field sampling program in the Alaskan Beaufort Sea, with 188 tests completed. This paper describes the sample preparation and test techniques developed in the program. Data on the compressive, tensile and confined compressive strength of the ridge ice samples are also summarized. Structure analyses of the samples have shown that the structure has a profound effect on the mechanical properties of the multi-year ice. In general, the compressive strength of the ice samples increased significantly with an increase in strain rate; beyond 10/sup -3/ s/sup -1/, where the ice is undergoing brittle failure, the compressive strength appears to level off. At a given strain rate, there is an increase in compressive strength with a decrease in temperature, a decrease in porosity, and increase in confining pressure. 28 refs., 8 figs., 4 tabs.

20334 (NRC/ACGR—NRCC28003TM41, pp 359-368) **Ice pressures during the impact of an ice mass.** Kivisild, H.R. (Lavalin Offshore, Inc.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Collision of an ice feature with an offshore structure creates variable contact pressures. The time average of these pressures is only a fraction of peaks and approaches the unit energy to fail ice. The unit energies can be applied to determine penetrations of structures and vessels into ice features. This defines contact areas and, in its turn, maximum contact forces. In the collision process, there are two peaks: one close to the initial impact and the other when the ice mass is stopped. The second can exceed the first by a wide margin. When the ice mass is stopped, its deepest penetration can be determined by using the ice breaking energy concept indicated in this paper. Other effects, such as those determined by ice properties and stochastic effects, are also discussed. In general, it is found that the application of formulas for ice breaking energy results in deeper penetrations by the colliding mass than would be obtained if the penetration were estimated at ultimate failure stresses. Dynamic analyses show that massive structures would respond to time average loads caused by light ice features; on the other hand, extreme ice features can cause sizeable impulses to be applied on large contact areas. 1 fig.

20335 (NRC/ACGR—NRCC28003TM41, pp 349-358) **Operational response to hazardous ice features.** Pilkington, J.R. (Pilkington and Associates, Calgary, Alta.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

This paper reviews the operational responses that would be carried out on an oil production structure in the Arctic if a hazardous ice feature should approach the structure. The definition of an acceptable risk is discussed in terms of the result of possible damange, economic losses, and acceptability to regulatory agencies. Calculation of risk probabilities is also outlined. A presentation is then made of what should be done if an ice hazard approaches which is estimated to exceed the design capabilities of the passive resistance of the structure. The first is an alert procedure, based on the time for the hazard to arrive, the time to secure the well, and the time to evacuate the structure; an example of ice loading and hazard assessment is presented for a production structure of octagonal shape and about twice the size of Gulf's Molikpaq structure. Other options are available for actively handling ice hazards, such as using explosives, ships, or towing; however, these seem to be applicable only to the smaller sized hazards. 16 refs.

20336 (NRC/ACGR—NRCC28003TM41, pp 335-346) **Remote sensing of extreme ice hazrds.** Leavitt, E.; Lowry, R. (INTRA Technologies Ltd., Calgary, Alta.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

The ability to operate safely in ice enfested areas during offshore operations has been enhanced by advances in the ability to monitor ice hazards using remote sensing methods. Sensors can be deployed on satellite, airborne or surface platform. Both visual or near infrared and microwave sensing have been applied to the ice monitoring problem. For real time operations, the visual and near infrared systems available are limited by visibility of the surface and

the problem of getting the data to the customer reliably. Microwave sensors include both passive and active systems. The passive systems, mostly deployed on satellites so far have relatively low resolution for detection of most ice hazards. However the active systems, including Side Looking Airborne Radarm both real aperture and synthetic aperture, have been used successfully to monitor such extreme ice features as icebergs, multiyear ice and ice islands in real time operations. Lately, search radars have been used successfully to detect icebergs of all sizes in variable sea states. Enhancements to surface marine radars are also improving their capabilities for use in hazard avoidance. 13 refs., 3 figs., 1 tabs.

20337 (NRC/ACGR—NRCC28003TM41, pp 305-333) **Methods of risk analysis.** Bercha, F.G. 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

The paper reviews the risk analysis of extreme ice features (those features which can cause problems for offshore structures). The discussion uses simple illustrations from daily life as well as references to non-trivial risk analyses carried out in order to assess extreme ice feature risk. Following an introduction on the applications of risk analysis, techniques of risk analysis which can be used as a basis for the evaluation of ice risk are presented and described. These include general methods and network methodologies such as fault tree analysis and Monte Carlo methods. A series of examples is presented base on projects covering extreme ice scour risk operations off the east coast of Canada, and detailed risk and risk mitigation analysis of Arctic and east coast ice and iceberg management management programs. Finally, the future of risk analysis is briefly discussed. It is concluded that risk analysis is a powerful tool for the evaluation of extreme ice feature risk. 28 refs., 11 figs., 1 tab.

20338 (NRC/ACGR—NRCC28003TM41, pp 279-302) **Ice/structure interaction research needs. Summary of workshop held in Calgary, 1986.** Zimmerman, T. (Centre for Frontier Engineering Research). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

In 1986, a series of workshops dealing with ice/structure interaction was held in Calgary, Alberta. The workshops looked at the state-of-the-art of ice/structure interaction, identified gaps in the knowledge that currently exist in Canada, and made recommendations regarding research needs. The invited participants included many experts in the field. The following seven areas were discussed: global and local ice loads including dynamic effects, physical modelling, rubble formation, monitoring and measuring systems, statistical and probabilistic aspects and failure criteria and structural response, for both steel and concrete. This paper summarizes the highlights from the workshop discussions and the recommendations regarding research needs. The consolidation of existing information and the acquisition of existing information pertaining to global, semi-local and local ice loads was identified as the top priority for ice/structure research.

20339 (NRC/ACGR—NRCC28003TM41, pp 233-275) **Extreme ice features - structure interaction.** Croasdale, K.R. 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

This paper presents an overview of the theory and mechanics of the interaction between ice and offshore structures. The relevance of current methods of prediction of ice loads due to extreme ice features, compared to measurements and observations from the field, is also discussed. A number of extreme ice feature loads are calculated according to the theories presented, and suggestions are made as to whether structures such as production platforms could resist such loads. Some general conclusions are as follows. Large-scale data obtained in the field indicate lower global ice crushing pressures than predicted using indentation theory and small-scale ice strengths. With an ice crushing strength of 1 megapascal and with ice thicker than ca 15-20 m, the advantage of a cone over a vertical structure may not exist. On sandy soils, it appears that large production platforms could be designed for extreme ice features up to 40 m thick, if limit force ice loads can be shown to govern. 9 refs., 21 figs., 2 tabs.

20340 (NRC/ACGR—NRCC28003TM41, pp 193-229) **Fracture mechanics and damage theory as a basis for calculation of ice-structure loads.** Jordaan, I.J. (Memorial Univ., St. John's, Nfld.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

The interaction of large ice features and fixed offshore structures can involve splitting and crushing of the ice feature. This paper presents a review of these phenomena. Most events observed in large scale ice-structure interaction occur at high enough velocities to cause the ice to fracture. The occurs as propagation of tension cracks or as crushing of ice where the stresses are compressive. Analysis of the former can be carried out by linear elastic fracture mechanics; complex geometries and boundary conditons can be studied using finite element methods. A promising direction for analysis of compressive crushing lies in the area of damage mechanics, particularly using shear damage models. Crushed ice can be modelled as a viscoplastic extruding material. These directions of research are discussed as well as the implication for ice-structure interaction. The alternating crushing and clearing process in ice is of great importance and provides an explanation for reduced average ice pressures as well as dynamic action excited during the ice-structure interaction process. The excitation could result from cycles of ice crushing and clearing. 62 refs., 9 figs.

20341 (NRC/ACGR—NRCC28003TM41, pp 67-77) **Mechanical properties of shelf ice.** Frederking, R.; Sinha, K. (National Research Council of Canada, Ottawa, Ont.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Arctic ice islands constitute one of the kinds of extreme ice features which must be taken into account in the planning of operations and design of offshore structures for the Beaufort Sea. This paper focuses on the mechanical properties of ice island ice. Because ice islands have their source in the remnant ice shelves of northern Ellesmere Island, it is assumed that the mechanical properties of ice island and shelf ice are the same. Since direct information on such properties is not available, the paper examines indirect methods for predicting properties. This is done by combining knowledge of the physical properties of shelf ice with knowledge of the mechanical properties of other types of ice which have similar physical characteristics. Some alternative approaches for direct measurement of mechanical properties are also considered. It is shown that shelf ice generally falls within the range of experience with other types of ice in terms of physical properties (density, salinity, temperature and grain structure). Therefore it is concluded that the mechanical properties of shelf will likely fall inside those measured for other ice types. The predictor equations available are

useful for establishing relative values for mechanical properties but not making estimates of absolute values. A more desirable approach, however, would be to conduct mecahnical property investigations directly on ice island ice. Any such investigations must have a parallel effort in which physical charcteristics of ice islands (e.g. temperatures, salinities, grain structure) are determined. 19 refs., 1 figs., 1 tab.

20342 **(STF—17A88038) Quality assurance in connection with the petroleum activities on the Norwegian continental shelf.** Aune, A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Jun 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757078/JAW.

The paper describes the main elements of the total quality assuranse system for the petroleum activities on the Norwegian continental shelf: Act pertaining to petroleum activities, and various regulations.The concept of "internal control". The licencees' responsibilities, requirements for the contractors' quality assurance, the project quality assurance system, quality assurance system manuals. 2 figs.

20343 **(STU—85-3816) Semi-submersible offshore platform. Forces, added mass, damping and motions in regular waves. A comparison between calculations and model tests.** Bjoerklund, J.; Lundgren, J. (SSPA Maritime Consulting AB, Goeteborg (SE)). (Swedish National Board for Technical Development, Stockholm; SSPA Maritime Consulting AB, Goeteborg (Sweden)). 17 Nov 1987. 77p. (SSPA—2640). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757085/JAW.

The report presents results of calculations and model tests of forces, added mass, damping and motions in regular waves for a semi-submersible offshore platform. Added mass and damping at different periods were obtained from forced oscillation tests. Wave forces were obtained by measuring the forces on the fixed model in regular waves of different periods.

20344 **(AC—AES/SAG1-2:86-16vl) Real and predicted motions in open-sea towed caissons. Vol. 1. Formal report.** Glen, I.; Menon, B.; Goossens, L.; Frere, D. (Arctec Canada Ltd., Kanata, Ontario). 1986. 71p. (CE—02351). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

During the summer of 1984, the tow of an offshore platform caisson from Japan to the Beaufort Sea was sucessfully monitored with a complete set of motion, load, and environmental sensors. The purpose of monitoring the two was to measure performance parameters of the tow, including motions and stresses in the caisson structure. From the data collected by the tow monitoring system, three test cases were selected and compared with predictions from the TASC computer model. Fair agreement was obtained between the predicted and measured caisson motions. The results indicated that the model overpredicted the resistance at low speeds and underpredicted the resistance at high speeds. The applicability and reliability of the tow monitoring system, a description of which is included in this report, was proven. The associated software developed for subsequent data reduction and analysis makes the complete software/hardware system readily available for future use. The data collected is to be used in setting future standards for caisson design, in evaluating towing proposals and in providing a data base for the development of regulations, if desired. 3 refs., 34 figs., 8 tabs.

20345 **(AC—AES/SAG1-2:86-14vl) Study of caisson towing and sinking methods. Vol. 1, formal report.** Menon, B. (Arctec Canada Ltd., Kanata, Ontario). 1986. 149p. (CE—02399). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Techniques commonly used in marine engineering to analyze and predict performance have been adapted to the specific requirements of towing and sinking caissons. These techniques have been incorporated into a computer program that has been developed to model the towing and sinking operations for a variety of barges and caissons under various user-specified conditions. Extensive analysis of wave-induced dynamics was performed for a number of representative cases in which the relevant parameters were systematically varied. A database was then created and used in the model. The database was created for a systematic series of barges and a number of types of caissons, and the program considers the following aspects of their behavior: stability, wave-induced motions and loads, drag, and forces in broken ice. Tug power, towline configuration and behavior, and positioning ballast requirements are also considered. This volume reviews the state of offshore caisson technology and towing techniques, and describes the development of the program in detail; software design and utilization are also outlined. 17 refs., 41 figs., 14 tabs.

20346 **(AC—AES/SAG1-2:86-14v2) Study of caisson towing and sinking methods. Vol.2, user's manual.** Menon, B. (Arctec Canada Ltd., Kanata, Ontario). 1986. 272p. (CE—02396). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A computer program called TASC has been developed to model the towing and sinking operations for a variety of barges and caissons under various user-specified conditions. The program includes a database of practical and hydrodynamic data, such as tug characteristics, towline properties, environmental data, barge and caisson resistance, and hydrostatic data; these data can be retrieved by the program in solving a specific problem. A user-friendly input routine, input data validity checks, and a program structure that allows expansion and modification offer significant advantages to the user of this program. At present, TASC covers the following aspects: barge and caission stability, barge weight estimation, wave-induced motions and loads, drag, tug power estimation, towline modelling, stability during barge unloading, forces occurring during positioning of caissons, positioning ballast requirements, and ice forces in broken ice. This user manual is intended to assist in operating the progam, and contains all the information required to run the program, to determine the input, and to interpret the output. Sample runs are included. 17 figs., 2 tabs.

20347 **(CME—AES/SAG1-2:86-16vl) Bearing capacity of broken ice zones.** Roth, D.R.; Marcellus, R.W.W. (Canadian Marine Engineering Ltd., Calgary, AB (Canada)). 1986. Vp. (CE—02397). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A review is presented of methods of calculating the bearing capacity and other properties of Arctic ice rubble. The calculations incorporate ice properties that can be applied to the bearing capacity problem. However, it should be noted that the properties are based on model or small-scale testing since little full-scale test data is available. Fragmented ice zones are treated as granular material conforming to a Mohr-Coulomb criterion having friction angles ranging from 11 to 58 degrees. This method of calculating bearing capacity is valid for a short time only after the ice is broken; significantly different results should be expected when the rubble refreezes. 36 refs., 13 figs., 2 tabs.

20348 **(AC—AES/SAG1-2:86-16v2) Real and predicted motions in open-sea towed caissons. Vol. 2. Tow monitoring data.** Glen, I.; Menon, B.; Goossens, L.; Frere, D. (Arctec Canada Ltd., Kanata, Ontario). 1986. 440p. (CE—02304). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A caisson for an offshore oil platform was towed from Japan to the Beaufort Sea, and monitoring was performed to measure open-sea motions and tow resistance. Caisson behavior was also modelled according to the TASC program and results were compared with the monitored data. This document presents the bulk of the recorded tow monitoring data, ASCII tape format information, and TASC output. 165 figs., 125 tabs.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 19216

4250 Power Cycles

REFER ALSO TO CITATION(S) 19859

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 20997

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 19429, 19430, 20265, 20267, 20364, 20650, 20653, 20983

20349 **(CRN-VIV—54) PLot insulators. Thoughts on a better design approach.** Heugel, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Apr 1988. 22p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757000/JAW.

The isolators used for electrostatic accelerators were examined. The electrical and mechanical stresses which these isolators have to withstand are linked to the metal isolator interface quality, i.e., the adhesion of the aluminium insert to the resin, so electrical and mechanical tests, and microscope examinations were carried out. The tensile strength of the best specimens is 20 tonnes without rupture, while the worst examples show inserts ripped out at 1 tonne. The relation between this mechanical behavior and behavior at high voltages is clearly established, even if it does not always show up clearly.

20350 **(CRN-VIV—58) Vivitron generator installation. State of progress. The situation as of 30 September 1988.** Heugel, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Sep 1988. 11p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757001/JAW.

Progress in installing the Vivitron generator structure and isolators as of 30 September 1988 is indicated. The next steps in the installation are summarized.

20351 **(DESY-L-Trans—319) Neutron low energy spectra behind IHEP accelerator shielding.** Belogorlov, E.A.; Britvich, G.I.; Krupnyi, G.I.; Lekedev, V.N.; Lukanin, V.S.; Makagonov, A.V.; Peleshko, V.N.; Rastsvetalov, Ya.N. (Institut Fiziki Vysokikh Ehnergij, Serpukhov (USSR)). (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1987. 22p. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.).

Translated from Russian. Published as preprint IFVE-85-148.

Typical neutrons spectra behind IHEP accelerator shielding are presented. They were measured with the help of Bonner spectrometer.

20352 **(FNAL/C—88/171) Redesign of the low energy section of the Fermilab linac to improve beam brightness.** Schmidt, C.; Noble, R.; Palkovic, J.; Mills, F.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 3p. (CONF-881049—68). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007486/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The critical parameters which limit the luminosity of the Fermilab Tevatron Collider are the beam emittances, both longitudinal and transverse, at each stage in the acceleration sequence. Improvements to reduce invariant emittance growth at earlier acceleration stages necessarily encourage improvements in all downstream stages. Recent advances in linac technology should permit a significant increase in the beam brightness of the Fermilab linac. A redesign of the low energy section of the linac is envisioned to include a circular aperture H/sup {minus}/ source, a short 30-keV transport line (solenoids, Gabor lenses or einzel lenses) for matching to a radio frequency quadrupole linac (RFQ), and injection at approximately 2 MeV into a new 200 MHz Alvarez linac tank for acceleration to 10 MeV. 9 refs., 1 fig.

20353 **(FNAL/C—88/179) An alternate side coupled structure for the Fermilab LINAC upgrade.** Jurgens, T.G.; Kerns, Q.A.; Fritz, J.R.; May, M.A. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 4p. (CONF-881049—67). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007480/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

An alternate side coupled structure (SCS) is being investigated. Comparisons are made to the traditional SCS. Mechanical comparisons include the relative cost and ease of fabrication. This discussion also addresses the use of CNC machining. Electrical comparisons include field distributions and coupling constants. Measured and numerical data are presented. The coupling constant of the alternate SCS is adjusted by independently changing either the separation of the coupling and accelerating cavity centers or the length of the slot. These two parameters are not independent in the traditional SCS design. 4 refs., 5 figs

20354 **(FNAL/C—88/211) Multi-processor developments in the United States for future high energy physics experiments and accelerators.** Gaines, I. (Fermi National Accelerator Lab., Batavia, IL (USA)). Mar 1988. Contract AC02-76CH03000. 10p. (CONF-8803123—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007481/JAW.

From International conference on the impact of digital microelectronics and microprocessors on particle physics; Trieste, Italy (28 Mar 1988).

The use of multi-processors for analysis and high-level triggering in High Energy Physics experiments, pioneered by the early emulator systems, has reached maturity, in particular with the multiple microprocessor systems in use at Fermilab. It is widely acknowledged that such systems will fulfill the major portion of the computing needs of future large experiments. Recent developments at Fermilab's Advanced Computer Program will make such systems even more powerful, cost-effective, and easier to use than they are at present. The next generation of microprocessors, already available, will provide CPU power of about one VAX 780 equivalent/$300, while supporting most VMS FORTRAN extensions and large (>8MB) amounts of memory. Low cost high density mass storage devices (based on video tape cartridge technology) will allow parallel I/O to remove potential I/O bottlenecks in systems of over 1000 VAX equipment processors. New interconnection schemes and system software will allow more flexible topologies and extremely high data bandwidth, especially for on-line systems. This talk will summarize the work at the Advanced Computer Program and the rest of the US in this field. 3 refs., 4 figs.

20355 **(IKDA—88/13) Superconducting 130 MeV electron accelerator at Darmstadt.** Aab, A.; Alrutz-Ziemssen, K.; Amend, R.; Flasche, D.; Graef, H.D.; Huck, V.; Hummel, K.D.; Knirsch, M.; Lindqvist, F.; Lotz, W. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik; Wuppertal Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 8 - Naturwissenschaften 1 - Physik). Jul 1988. 5p. (CONF-880695—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756949/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Since the superconducting injector linac of the accelerator produced a first beam in August 87 the first cryomodule of the main linac containing another two accelerating structures has been installed and operated. The final concept of the rf control circuits has been developed and two prototype channels were operated successfully in an acceleration test with five superconducting structures. The beam from the injector linac was used routinely for atomic and nuclear physics experiments during the last four months.

20356 **(IKDA—88/20) Darmstadt superconducting linac.** Graef, H.D.; Richter, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). Oct 1988. 7p. (CONF-881049—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756953/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Since the superconducting injector of the accelerator produced a first beam in August 87 the first half of the main linac (two cryogenic modules containing four superconducting structures) has been installed. Four channels of the newly developed rf control system have been built and successfully tested with the main linac, three defective tuners have however prevented a beam test using all of the installed structures simultaneously. The beam from the injector linac was used routinely for atomic and nuclear physics experiments during the course of this year.

20357 **(INFN-LNF—88-21(P)) B factory. Which energy is the best.** Peruzzi, I. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 18p. (CONF-871299—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705730/JAW.

From Workshop on heavy quarks factory and nuclear physics facility with superconducting linacs; Courmayeur, Italy (14 Dec 1987).

Various energy choice are considered for studying B Physics at the Frascati project ARES; the option of an asymmetric machine is particularly discussed and the pros and cons weighted. Results from a Montecarlo simulation in several energy configurations are presented.

20358 (INIS-BR—1411, pp 80-89) **Radiation protection in cyclotron and radioisotope production laboratories of IEN - (Instituto de Engenharia Nuclear - CNEN).** Fajardo, P.W.; Silva, J.J.G. (Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The Cyclotron at Instituto de Engenharia Nuclear is used for the radioisotope production, neutron production and irradiation damages analysis, etc. The risks associated with the operation and maintenance of cyclotron and the neutron radiation of wide energy spectrum, external and internal contamination. A summary of the radioprotection program for these areas are show and the results obtained from the air and surface analysis, liquid efluents and equivalentes doses of workers of the several activities are given.

20359 (INIS-SU—70, pp 18-20) **On dimensions of interaction region of optical radiation with relativistic particle beam.** Yakimenko, M.N. 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

The effect of parameters of the optical radiation focusing system on the interaction region dimensions and luminosity is considered for the process of interaction of optical radiation with a relativistic particle beam. It is shown that the interaction region length is not a free parameter and it depends on the focusing system parameters. 2 refs.; 1 fig.; 1 tab.

20360 **(JAERI-M—88-181) JAERI tandem, linac and V.D.G. annual report 1987. April 1, 1987 - March 31, 1988.** (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 230p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756904/JAW.

This annual report describes research activities which have been performed with the JAERI tandem accelerator, the electron linear accelerator and the Van de Graaff accelerator from April 1, 1987 to March 31, 1988. Summary reports of 49 papers, and list of publications, personnel and cooperative researches with universities are contained.

20361 **(LA-UR—89-6) A compendium of computer codes used in particle accelerator design and analysis.** (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 191p. (CONF-8707208—6). NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006542/JAW.

From Physics of particle accelerators summer school; Batavia, IL, USA (20 Jul 1987).

In preparing this compilation, we came across the names of more than 150 programs that have been used in the design and analysis of accelerators. Many are obsolete and some are not easily transported from the institution where they were created. All are included in this compilation and filed at Los Alamos, but the obsolete codes have been removed from this article. Other than the judgment as to whether or not a particular code is obsolete, we have not made any critical evaluations. Computer codes and code compilations share the common problem of obsolescence. This compilation will probably be almost useless in three years or less. Useful codes become widely distributed. Users make improvements in distributed code, and the original author loses control over the evolution of the code as variations proliferate. Every generation of accelerator physicists produces code-builders; persons who feel that they can design more comprehensive or easier-to-use codes to do the tasks done by previous codes. This document is organized so that each code is described on a one- or two-page data sheet. The data sheets are arranged alphabetically by code name but are not numbered. In this way, it will be easy to insert new codes as they are discovered. There are a number of simulation codes that have no names, and we have not taken the time to obtain detailed information on all of them. However, there are two fairly current codes that we thought worthwhile to include here. Therefore we have arbitrarily assigned them names. One of these is a CERN code by Myers, which we have called BEAMBEAM and the other is a DESY code by Piwinski, which we have called BMBMI. The code data sheets are preceded by three indexes: subject, person-to-contact, and code acronym. It was not useful to list codes by authors because, in many cases, the original author is no longer associated with the code and many other persons have contributed to maintaining and improving the code.

20362 **(RAL—88-094) Saturation and cross field coupling of beat-driven 3-D plasma waves.** Miano, G.; Angelis, U. de; Bingham, R. (Naples Univ. (Italy)). (Rutherford Appleton Lab., Chilton (UK)). Oct 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706125/JAW.

Using 3-D relativistic fluid equations the dynamics for the plasma beat wave generated by two circularly polarized electromagnetic waves with Gaussian profiles is obtained. We find there is a strong cross field coupling between the longitudinal and radial electric field components of the beat wave resulting in a nonlinear phase change and energy transfer between these two components. The resulting beat wave structure being controlled more by this cross-field coupling than by the other nonlinear terms such as the nonlinear coupling to the laser beams with the result that the accelerating region of the plasma beat wave is much more restrictive than previously calculated.

20363 **How big is a cyclotron?.** Brown, L.S. (Department of Physics, FM-15, University of Washington, Seattle, Washington 98195). *American Journal of Physics;* **57**: No. 4, 308-309(Apr 1989).

The radius of the orbit of a particle of given energy in a laboratory cyclotron is computed in terms of the Bohr radius of the hydrogen atom a_0 and the fine structure constant α.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 20650

20364 **(ANL/PPRNT—89-93) Concept for simultaneous acceleration/deceleration of heavy ions in a single rf linac.** Bollinger, L.M. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008428/JAW.

This paper outlines a concept for obtaining highly-stripped low- velocity heavy ions by accelerating an ion beam with an rf linac and then, after stripping, using the same linac to reversibly decelerate the beam back to the injection energy. The synchronous-phase requirement and the matching relationship in longitudinal phase space are stated, and a realistic example of these relationships is given for a ^{58}Ni beam. The probable performance characteristics of the ATLAS superconducting linac operated in this new accel/decel mode are discussed. 11 refs., 2 figs.

20365 **(ANL/PPRNT—89-165) A plasma lens for a linear collider final focus.** Norem, J.; Cline, D.B.; Cole, B.; Rosenzweig, J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008358/JAW.

High density relativistic beams propagating in a plasma are affected by fields induced by plasma motion. We consider the possible use of a plasma cell very close to the interaction point of a linear collider where the self-pinch induced in the relativistic beams can be used to increase the luminosity of colliding beams. We describe the benefits of this self-pinch, as well as some engineering details on the production of the required plasma. 18 refs., 5 figs., 1 tab.

20366 **(BNL—42195) Fundamentals: Longitudinal motion.** Weng, W.T. (Brookhaven National Lab., Upton, NY (USA)). 7 Nov 1988. Contract AC02-76CH00016. 63p. (CONF-8708323—1). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007044/JAW.

From US summer school on high energy particle accelerators; Chicago, IL, USA (1 Aug 1987).

This paper discusses the following topics on synchrotrons: Dynamics of Synchrotron; Acceleration Cavity; Beam Manipulation and Beam Control; and High Intensity Effects. 21 refs., 26 figs. (LSP)

20367 **(CONF-8810321—1) Order in cold ionic systems: Dynamic effects.** Schiffer, J.P. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007377/JAW.

From Workshop on crystalline ion beams; Wertheim, F.R. Germany (4 Oct 1988).

The present state and recent developments in Molecular Dynamics calculations modeling cooled heavy-ion beams are summarized. First, a frame of reference is established, summarizing what has happened in the past; then the properties of model systems of cold ions studied in Molecular Dynamics calculations are reviewed, with static boundary conditions with which an ordered state is revealed; finally, more recent results on such modelling, adding the complications in the (time-dependent) boundary conditions that begin to approach real storage rings (ion traps) are reported. 14 refs., 19 figs., 2 tabs.

20368 **(FNAL/C—88/175) Observation of transverse instabilities in the FNAL 200 MeV Linac.** McCrory, E.; Lee, G.; Webber, R.C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 4p. (CONF-881049—69). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007476/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Using newly installed Beam Position Monitors in the downstream half of the FNAL Linac, we have observed significant transverse beam instabilities within the 30 μs beam pulse. We can affect the instability so that the peak-to-peak amplitude is as small as 0.5 mm or as large as 8 mm. The effect is largely due to a beam-plasma instability in the ten-meter 750-keV transport line. Other causes are being investigated. Using these instabilities as an analysis tool, the betatron amplitude of the beam has been reduced. 7 refs., 4 figs.

20369 **(FNAL/C—88/177) Measurements on a Gabor lens for neutralizing and focusing a 30 keV proton beam.** Palkovic, J.A.; Hren, R.; Lee, G.; Mills, F.E.; Schmidt, C.W.; Wendt, J.; Young, D.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 4p. (CONF-881049—70). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007478/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We have reported previously on the use of a Gabor lens (also referred to as a plasma or space charge lens) to focus and neutralize a low energy proton beam. A different lens geometry and a higher anode voltage have been adopted to overcome a lack of stability present in the previous design. We report on studies in progress to measure the focusing properties of the Gabor lens and determine whether it can be used to match a 30 keV proton beam into a radio frequency quadrupole (RFQ) Accelerator. 10 refs., 4 figs.

20370 **(LA-UR—89-652) Multipole correction in synchrotrons.** Neuffer, D. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 4p. (CONF-890335—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008018/JAW.

From 13. particle accelerator conference; Chicago, IL, USA (20 Mar 1989).

New methods of correcting dynamic nonlinearities resulting from the multipole content of a synchrotron are presented and discussed. In a simplest form, correction elements are placed at the center (C) of the accelerator half-cells as well as near the focusing (F) and defocusing (D) quadrupoles. In a first approximation, the corrector strengths follow Simpson's Rule. The F, C, and D correctors also permit direct control of horizontal, coupled, and vertical motion. For example, second-order sextupole nonlinearities can be corrected with F, C, and D octupoles. Generalizations and variations of the methods are described and applications to the SSC, LHC, AHF, and HERA projects are discussed. Correction by three or more orders of magnitude can be obtained, and simple solutions to a fundamental problem in synchrotrons are demonstrated. 13 refs., 2 figs., 1 tab.

20371 **(NIKHEF-K-LINO—156) Video-framestore for bundle monitors.** Nootebos, M.H. (HTS, Amsterdam (Netherlands). Informatietechniek). (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). Jun 1988. 127p. (In Dutch). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706114/JAW.

An investigation has been performed into the possibilities for storing in the memory and processing of a videoframe starting from a home computer. The possibility has been investigated for submitting the video pictures to a simple treatment. The limitations are analyzed and established. An improved circuit has been developed and tested. An investigation has been performed into commercially available professional apparatus and recommendations are given. refs.; figs.; tabs.

20372 **The use of toroidal boundary conditions in the program poisson.** Caspi, S.; Helm, M.; Laslett, L.J. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1532-1535(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

In circular particle accelerators of moderate size, one cannot entirely neglect the curvature of the structure and of the guide field. In practice, one may wish to restrict the region of analysis to that near the working aperture, while excluding a very substantial

area closer to (and including) the axis of rotational symmetry. In this way, a more efficient mesh can be generated for a program such as POISSON. In restricting the solution to the region of interest, there must be concern regarding a suitable termination of the problem at the boundary of the mesh. For these reasons, we have employed toroidal coordinates in constructing the boundary to a relaxation mesh, and in formulating the boundary conditions that then would be imposed at such boundaries.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 20368, 20369, 20414, 20931, 20931

20373 **(CONF-8810182—15) New instruments at IPNS: POSY II and SAD II.** Crawford, R.K.; Felcher, G.P.; Kleb, R.; Epperson, J.E.; Thiyagarajan, P. (Argonne National Lab., IL (USA)). 29 Sep 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007382/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

Three new instruments are currently in varying degrees of development/construction at IPNS. One of these, the Glass, Liquid, and Amorphous Materials Diffractometer (GLAD) is the subject of a separate paper in these Proceedings, and so will not be discussed further here. The other two, a second neutron reflectometer (POSY II) and a second small-angle diffractometer (SAD II) are described briefly below. 5 refs., 1 fig., 1 tab.

20374 **(CONF-8810182—16) Status of the intense pulsed neutron source.** Brown, B.S.; Carpenter, J.M.; Crawford, R.K.; Rauchas, A.V.; Schulke, A.W.; Worlton, T.G. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007381/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

IPNS is not unique in having concerns about the level of funding, and the future looks good despite these concerns. This report details the progress made at IPNS during the last two years. Other papers in these proceedings discuss in detail the status of the enriched uranium Booster target, the two instruments that are under construction, GLAD and POSY II, and a proposal for research on an Advanced Pulsed Neutron Source (ASPUN) that has been submitted to the Department of Energy (DOE). Further details on IPNS are available in the IPNS Progress Report 1987--1988, available by writing the IPNS Division Office. 9 refs., 3 tabs.

20375 **(CONF-8810182—17) Soller collimators for small angle neutron scattering.** Crawford, R.K.; Epperson, J.E.; Thiyagarajan, P. (Argonne National Lab., IL (USA)). 30 Sep 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007379/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

Small angle diffractometers at pulsed sources need to have fairly short flight paths if they are to make use of the long-wavelength portion of the spectrum without encountering problems from frame overlap or sacrificing intensity with band-limiting or pulse-removing choppers. With such short flight paths, achieving the necessary angular collimation in the incident beam while utilizing the full source size ({approximately}10 cm diameter) and a reasonable sample size ({approximately}1 cm diameter) requires the use of converging multiple-aperture collimation. If the collimation channels are all focused to the same point on the detector then the large sample size will not affect Q/sub min/ or the Q-resolution, even if the sample-to-detector distance is short. The Small Angle Diffractometer (SAD) at IPNS uses crossed converging soller collimators to provide focusing multiple-aperture collimation having {approximately}400 converging beam channels with essentially no "dead" space between them. This entire collimator system occupies a distance of only {approximately}60 cm along the incident flight path, while providing angular collimation of 0.003 radians FWHM. The dimensions for the SAD upstream collimator are L/sub c/ = 32.8 cm, d_1 = 0.974 mm, d_2 = 0.851 mm, while for the SAD downstream collimator L/sub c/ = 25.0 cm, d_1 - 0.844 mm, d_2 = 0.750 mm. Each of these collimators has 20 blades defining 21 horizontal or vertical channels. 4 refs., 6 figs.

20376 **(DOE/ER/40345—8) On-line nuclear orientation: Second annual progress report, April 1, 1987--March 31, 1988 (year 1 of 3).** Krane, K.S. (Oregon State Univ., Corvallis (USA). Dept. of Physics). 1988. Contract FG06-87ER40345. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008217/JAW.

The first year of a three-year contract has been spent in the preparation for the operation of the UNISOR Nuclear Orientation Facility, and on-line low-temperature refrigerator capable of orienting implanted nuclei produced at the Holifield Heavy-Ion Research Facility (HHIRF). Preparations have included design of the physical facility and training of graduate students to be experimenters. This report summarizes those activities and discusses the experimental program. 6 refs., 8 figs.

20377 **(DOE/ER/40374—14) RFQ [radio-frequency quadrupole] acceleration section and its optimization.** Raparia, D. (Houston Univ., TX (USA)). 1988. Contract FG05-87ER40374. 4p. (CONF-881049—72). NTIS, PC A02 - OSTI. Order Number DE89007391/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The acceleration section is a crucial component of any radio-frequency quadrupole (RFQ). It is common a practice to design this section with a constant modulation factor equal to its value at the end of the gentle buncher. A new method of design is proposed in this paper. The algorithm is based on the fact that the transverse space-charge current limit (TCL) is approximately proportional to the instantaneous velocity of the accelerated particle and the longitudinal space-charge current limit (LCL) is nearly independent of the velocity in the acceleration section. The modulation factor is increased such that the TCL is slightly larger than the double of the design current. Simulation using this method shows that transmission efficiency and emittances are the same as the conventional design. The advantage gained is a 50-75% increase in accelerating rate. The optimization of the length of this section is also discussed. 3 refs., 4 figs., 1 tab.

20378 **(FNAL/C—88/176) Beam transport with magnetic solenoids and plasma lenses.** Noble, R.J. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 4p. (CONF-881049—71). NTIS, PC A02 - OSTI. Order Number DE89007477/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We examine the behavior of axisymmetric space-charge dominated beams in transport lines using numerical simulation. A typical transport line consisting of two axisymmetric linear lenses used to make a continuous beam from an ion source to a radio frequency quadrupole (RFQ) is considered. We compare the beam evolution when both lenses are magnetic solenoids or Gabor plasma lenses for beams with different initial density profiles. Emittance oscillations due to nonlinear space-charge forces by the action of plasma lenses in which space-charge fields are shielded, but beam mismatch at the RFQ entrance can be significant for both types of lens. 8 refs., 6 figs.

20379 **(IKDA—88/12) Near-infrared free-electron-laser project at Darmstadt.** Aab, V.; Alrutz-Ziemssen, K.; Genz, H.; Graef, H.D.; Richter, A.; Weise, H.; Gaupp, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik; Berliner Elektronenspeicherring-Gesellschaft fuer Synchrotronstrahlung m.b.H. (BESSY), Berlin (Germany, F.R.)). (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). Jul 1988. 4p. (CONF-880695—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756948/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The superconducting 130 MeV electron accelerator at Darmstadt will be modified for FEL experiments. The FEL project is planned with an electron beam in an energy range from 35 to 50

MeV corresponding to wavelengths from 4.9 to 2.4 μm. The planned FEL setup, a high current injection, the design of a hybrid undulator and the results of simulations of the FEL are presented.

20380 (INIS-mf—11358, pp 65) **Generation of intense heat fluxes by electron bombardment to evaluate the use of Swirl flow in the cooling of accelerator targets - final results.** Genis, G.J.; Rautenbach, W.L. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria; Stellenbosch Univ. (South Africa)). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

20381 **(JINR—13-87-820) Control and optimization of parameters of the low energy meson beams.** Gajsak, I.I.; Davydov, Yu.I.; Merzlyakov, S.I.; Oganesyan, K.O.; Pasyuk, E.A.; Porokhovoj, S.Yu.; Rudenko, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705558/JAW.

The effective and simple methods for control and optimization of beam contents, energy and energy spread of the low energy meson beams is described. These methods can be used in experiments on meson beams of JINR phasotron and other accelerators. 2 refs.; 4 figs.

20382 **(LA-UR—89-678) LANSCE target calculations.** Grisham, D.L.; Brown, R.D. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 11p. (CONF-8810182—20). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89008017/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

The LANSCE target operates at a beam current of 30 microamps. We present here the results of the finite-element calculations for the temperatures and stresses in the present target operated at 100 microamps. The calculations were run using the ABAQUS finite-element code. All finite-element codes require as input both the boundary conditions for the material being heated, and such material properties as the thermal conductivity, specific heat, and the elastic modulus. For the LANSCE target, the boundary conditions involve knowing the power deposition from the beam, and the heat transfer coefficients between the tungsten-alloy cylinder and the cooling water. We believe that these numbers are quite well established. 5 refs., 6 figs.

20383 **(LBL—25884) Design of a pulsed switching magnet for the Bevalac.** Abbott, S.; Alonso, J.; Brown, J.; Kalnins, J.; Krebs, G.; Reimers, R. (Lawrence Berkeley Lab., CA (USA)). Mar 1989. Contract AC03-76SF00098. 6p. (CONF-890335—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008335/JAW.

From 13. particle accelerator conference; Chicago, IL, USA (20 Mar 1989).

The design and construction of a water cooled, pulsed, laminated core dipole magnet which has recently been installed at the Bevalac is described. This new, energy efficient magnet was funded by the DOE In-House Energy Management Program. The magnet has been specifically designed for maximum efficiency in power utilization and has replaced two dc powered magnets in the Bevalac switchyard. It will reduce energy usage by 747 MWh/yr, and it provides the capability of pulse-to-pulse switching in 0.7 seconds between two major beamline channels serving the nuclear science and radiotherapy programs at the /Bevalac. A unique feature of this magnet is the core design which utilizes an external structure that remains integral with the core laminations after assembly. The structure provides for both torsional and longitudinal rigidity of the core while also facilitating the precision assembly and compression of the core laminations without the use of special assembly fixtures. 2 refs., 4 figs., 1 tab.

20384 **(LBL—25890) Design of an integrally formed RFQ.** Abbott, S.; Caylor, R.; Gough, R.; Howard, D.; MacGill, R.; Staples, J. (Lawrence Berkeley Lab., CA (USA)). Mar 1989. Contract AC03-76SF00098. 6p. (CONF-890335—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008334/JAW.

From 13. particle accelerator conference; Chicago, IL, USA (20 Mar 1989).

The design, construction and testing of a 410 MHz RFQ utilizing a new mechanical design concept has been completed at LBL. The RFQ is planned to be used at the Bevatron for injecting protons into the present heavy ion linac. The integral vane-cavity construction is a significant and unique feature of this RFQ design, wherein four walls with integral vanes are assembled to form the RFQ geometry. This design concept provides the capability of achieving precision vane alignment in minimal assembly time with no adjustments required. The design concept including material selection, plating, vacuum seal design, assembly and testing are described. 4 refs., 4 figs., 1 tab.

20385 **(LBL—26003) AC magnetic measurements of the ALS Booster Synchrotron Dipole Magnet engineering model.** Green, M.I.; Hoyer, E.; Keller, R.; Nelson, D.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 11p. (CONF-8810196—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007662/JAW.

From Magnet design workshop; Vancouver, Canada (3 Oct 1988).

We made a minimal set of AC magnetic measurements of the engineering model of the ALS Booster Dipole Magnet as part of the process of qualifying its design for production. Magnetic induction integrals over paths approximating electron-beam trajectories were measured with long curved coils connected to an electronic integrator. Magnetic induction was measured with point coils and an integrator and independently with a Hall-effect Gaussmeter. These quantities, and magnet current, were displayed on a commercial digital storage oscilloscope as parametric functions of time. The displayed waveforms were stored, processed and redisplayed as representations of selected magnet parameters. A waveform representing the magnet's effective-length was created by dividing the integral waveform by the magnetic induction waveform. Waveforms of the transfer functions were produced by dividing both the integral waveform and the magnetic induction waveform by the current waveform. Pairs of matched coils, connected in series opposition, provided differential measurements of field uniformity. Quadrupole and sextupole coefficients were derived from the uniformity data. These magnet parameters were measured at 2 and 10 Hz frequencies. Together with measurements of the magnetic field at selected dc levels, the ac measurements demonstrated that the magnet design met specifications and qualified it for production. 7 refs., 7 figs., 3 tabs.

20386 **(NIKHEF-K-LINO—155) Quality measurements of resonance cavities in behalf of investigation of microwave properties of superconducting materials.** Dekkers, G.; Ridder, M. de.; NIKHEF-K - Hogeschool Utrecht afd. E Collaboration. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 9 May 1988. 150p. (In Dutch). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706113/JAW.

A method for investigating conducting properties at microwave frequencies of superconducting materials by means of quality measurements of a resonance cavity is described. The method is based on the direct relationship of the quality factor of a resonance circuit, in this case a resonance cavity, with the losses in the circuit. In a resonance cavity these losses are caused by the material properties of the resonance cavity. Therefore quality measurements yield, essentially, a possibility for investigation of conducting properties of materials. The underlying theory of the subject, the design of a special resonance cavity, the measuring methods and the accuracy in the relation of the measured quality factor and the specific conductivity of the material is presented. refs.; figs.; tabs.

20387 (SLAC—316, pp 47-53) **Polarized electrons for internal target experiments.** Norum, B.E. (Univ. of Virginia, Charlottesville (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Stated briefly, the problem is to maintain polarized electrons in a storage ring such that at a particular point in the ring the direction of polarization is parallel to the beam momentum. At other points in the ring the polarization must be oriented to ensure that the magnitude of the polarization of the stored electrons is maintained at as high a level as possible. Possible solutions for the PEP storage ring and the proposed MIT-Bates storage ring will be discussed.

20388 (SLAC—316, pp 54-65) **Use of internal targets at the proposed MIT/Bates ring.** Flanz, J.B. (MIT-Bates Linear Accelerator Center, Middleton, MA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The construction of a ring at the MIT/Bates Accelerator Center has been proposed since 1984. It would operate as a Pulse Stretcher Ring (PSR), providing near CW electron beams of up to 1 GeV to the existing experimental apparatus at Bates. The proposal also includes a unique facility for conducting experiments using internal targets (IT). The present layout of Bates is shown in Fig. 1. The machine, as shown, produces a beam whose quality is summarized by the parameters in Table I. The laboratory currently supports three experimental halls with five main beam lines. On the B line exists three spectrometers with characteristics that make them well suited for coincidence measurements [1]. However, at present as listed in Table I, the duty factor available is limited to one percent. The proposed additions to the laboratory are shown in Fig. 2. The pulsed beam from the accelerator would be injected into the ring in a short straight section on the right side. The CW beam would be extracted from the upper long straight section. Also included is an energy compressor system to reduce the effective energy spread of the beam. The resulting beam parameters after the proposed additions are presented.

20389 (SLAC—316, pp 66-75) **Internal target physics at 1 GeV.** Kowalski, S. (Massachusetts Institute of Technology, Cambridge (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The use of internal targets operating at high luminosity in an electron storage ring in the energy range 0.3 - 1.0 GeV is discussed. Examples are presented of fundamental physics problems which would be ideally suited to such a unique new capability. Special emphasis is placed on the use of polarized targets to measure spin observables and thus provide a Multipole Meter for separating individual form factor multipoles. The combination of laser technology with optical pumping now makes possible the polarization of a broad class of nuclear species to useful densities. The importance of longitudinally polarized electrons for studying nuclear structure is also discussed.

20390 (SLAC—316, pp 92-98) **Experience with a warm gas jet target for nuclear physics.** Hirsch, A.S. (Purdue Univ., West Lafayette, IN (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

A room temperature pulsed internal gas jet target has been used in the main ring at both FNAL and the Brookhaven AGS in order to study proton-nucleus collisions. The authors have produced ultra-thin targets in the range of 1-100 ng/cm^2 using a variety of pure and mixed gases.

20391 (SLAC—316, pp 99-102) **Possibilities for polarized internal targets.** McKeown, R.D. (California Institute of Technology, Pasadena (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

An important feature of experiments with internal targets in storage rings is the possibility of using thin polarized gas targets. Various methods of polarizing different nuclei are under development, and suitable target thicknesses appear quite feasible. A survey of techniques is presented with a discussion of advantages, disadvantages and possible problems that will need to be addressed.

20392 (SLAC—316, pp 103-110) **Large acceptance magnetic spectrometer for CEBAF.** Mecking, B.A. (CEBAF, Newport News, VA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The scientific program for the CEBAF 4 GeV electron accelerator aims at studying the structure and the motion of the nuclear constituents. The experimental equipment that has been proposed consists of focusing magnetic spectrometers with relatively small acceptances (Δ Omega $\approx 10^{-3} \times 4\pi$, $\Delta p/p \approx 10\%$) but high momentum resolution ($\Delta p/p \leqq 10^{-4}$) and a large acceptance spectrometer. The physics motivation for a large acceptance detector, the general design criteria and technical details of the detector are presented.

20393 (SLAC—316, pp 118-126) **Nuclear physics IR for PEP - issues and conceptual design.** Van Bibber, K. (Lawrence Livermore National Lab., CA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

A conceptual design for a nuclear physics interaction region at PEP is presented. The design is based on components of the 2γ (PEP-9) detector, configured as a large acceptance forward angle spectrometer suited for asymmetric fixed target kinematics. The system is evaluated with a prototype experiment in mind, namely pion production in quasielastic kinematics, (e,e'π). Issues and open questions particular to internal target work are discussed.

20394 (SLAC—316, pp 148-150) **H_2 gas jet as internal target.** Fay, J.; Macri, M. (IPN, Lyons (France)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Experiment R704, the last to be performed at the CERN Intersecting Storage Rings, has successfully applied a new method to studying (anti c c) states formed directly in antiproton-proton annihilations. The novelty of the method lies in the capability of building a highly performing annihilation source by letting a cold antiproton beam, coasting inside ring 2 at the ISR, continuously interact with a dense internal H_2 target. Details of the characteristics of the source are given in this paper.

20395 (SLAC—316, pp 180-185) **Development of a warm gas jet target for PEP.** Molitoris, J.D.; Van Bibber, K.A. (Lawrence Livermore National Lab., CA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The authors are presently involved in a feasibility and design study of a warm gas jet target system for PEP. Their aim is to construct a low throughput system which will produce a target of dimensions less than 1 cm^3 with areal densities in the range $\approx 10^{-8}$ - 10^{-10} g/cm^2.

20396 (SLAC—316, pp 195-199) **Electromagnetic physics with a polarized ^{3}He internal target.** Milner, R.G. (California Institute of Technology, Pasadena (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

To date, the only targets of polarized nuclei considered in detail for polarization studies in electromagnetic physics have been the proton, the deuteron, and ^{165}Ho. The targets require both cryogenics and intense magnetic fields to produce polarization of order 50%. These intense magnetic fields are a likely source of systematic error measurement of small asymmetries in that they will deflect both the incident and scattered beams. Luminosities are limited to $\approx 10^{35}$ cm^{-2}s^{1} by depolarization of the target. A promising ideas, which would eliminate many of the above problems, is to use an internal target of density 2 x 10^{15}cm^{-2} of polarized atoms in an electron storage ring with a stored current of 100 mA. This would provide a luminosity of 10^{33}cm^{-2}s^{-1} and would use a new generation of polarized few-nucleon targets based on the method of optical pumping. These targets have the advantages of requiring only few gauss holding fields and do not give rise to any dilution of the measured asymmetry in that the polarized atoms are pure atomic species. The authors have been working on the development of a polarized ^{3}He target. ^{3}He has the advantages that a direct optical pumping technique exists and also that its interaction with containment walls is very weak.

20397 (SLAC—316, pp 210-211) **Tagged photon beam from Bremsstrahlung on an argon jet target.** Anghinolfi, M.; Bertocchi, A.; Bianchi, N.; Capitani, G.P.; Corvisiero, P.; De Sanctis, E.; Frullani, S.; Garibaldi, F.; Guaraldo, C.; Sandri, P.L. (I.N.F.N., Genova (Italy)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

A proposed monochromatic photon beam produced by the tagging technique is described. The radiator is a condensed molecular beam of argon (thickness 10^{-8} g/cm^{2}) installed in a straight section of the Adone storage ring. The recoil electron counters are placed in the magnetic field of the next dipole ring. The tagging system defines 80 channels (each 1% resolution) covering the photon energy range (0.4 - 0.8 E/sub o/). The total photon intensity is about 10^{8} sec^{-1}.

20398 **The electron damping ring for the SLAC linear collider.** Davies-White, W.; Hutton, A.; Harvey, A. (Stanford Linear Accelerator Center, Stanford, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1327-1330(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A second damping ring to store and damp two electron bunches for the SLC project was constructed in 1985 and brought into operation early in 1986. Although generally similar to the damping ring (now used for positrons) constructed earlier, there are a number of design improvements and changes. The dipole magnetic field was raised to 2.1 T to improve damping. Sextupole fields were provided by separate permanent magnets, rather than being incorporated in the dipoles. The vacuum-chambers, including the beam position monitors, were re-designed for lower longitudinal impedance. A new kicker was developed by Fermilab to handle the two electron bunches. Improvements were made to the dc septum magnet design. Several of the features are described in detail elsewhere. Where possible, the improvements were incorporated in an upgrade of the earlier damping ring.

20399 **Magnetic field calculations of a permanent magnet insertion device for the advanced photon source.** Kim, S.H. (Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1102-1104(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The magnetic fields of a hybrid undulator for the 7-GeV Advanced Photon Source (APS) have been calculated. The 2-D geometries of regular poles and end pole are chosen using PANDIRA and PE2D codes. The field distribution in 3-D geometry are calculated using the TOSCA code. It is shown that the undulator dimensions should be chosen according to the requirements of the final use. TOSCA calculations in the 2-D limit agreed remarkably well with the results of PANDIRA and PE2D.

20400 **Improving the quality of existing quadrupoles.** Hunter, W.T.; Bush, E.D. Jr.; Perez, E.M.; Archuletta, S.F.; Mays, M.G. (Los Alamos National Lab., Los Alamos, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1358-1360(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A cost-effective method is shown for improving the quality of existing quadrupole magnets. In this case, the LAMPF side-coupled-linac (SCL) quadrupole doublets are being upgraded so that improved harmonics and increased integrated gradient strength can be achieved. Data are shown for the old and new states that verify these improvements. The use of investment casting technology to achieve these improvements is documented.

20401 **Test results from 1.8-m SSC model dipoles.** Wanderer, P.; Cottingham, J.G.; Dahl, P.; Garber, M.; Ghosh, A.; Goodzeit, C.; Greene, A.; Herrera, J.; Kahn, S.; Kelly, E. (Brookhaven National Lab., Upton, NY (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 816-819(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The authors report results from the first four in a series of 1.8 m-long and dipoles built as part of the Superconducting Super Collider (SSC) R and D program. Except for length, these models have the features of the SSC design, which is based on a two-layer cosθ coil with 4 cm aperture. As compared to 17 m, the SSC design length, these 1.8 m magnets are a faster and more economical way of testing changes in field shape, the ratio of copper to superconductor, cable support at the coil center and ends, and similar variables. The two most recent magnets in this series have the design field shape and improved quench performance.

20402 **Tests of prototype SSC magnets.** Strait, J.; Brown, B.C.; Hanft, R.; Koepke, K.; Kuchnir, M.; Lundy, R.; Mantsch, P.; Mazur, P.O.; McInturff, A.; Orr, J.R. (Fermi National Accelerator Lab., Batavia, IL (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 730-733(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Results are presented from tests of the third full scale development dipole magnet for the Superconducting Super Collider and from a retest of a 4.5 m model magnet of the same design mounted in an SSC cryostat. The 4.5 m magnet shows consistent quench performance between its original tests in boiling liquid helium in a vertical dewar and the current tests in forced flow helium in a horizontal cryostat. Little or no retraining is observed over several thermal cycles. The full length magnet requires 12 quenches to train to its short sample limit of 6800 A and displays a reasonably stable quench plateau following training. This represents a great improvement over the performance of the first two full length magnets. Data are presented on quench behavior as a function of current and temperature and on azimuthal and longitudinal loading of the coil by the support structure.

20403 **SSC magnet technology.** Taylor, C. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 726-729(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

To minimize cost of the SSC facility, small-bore high field dipole magnets have been developed; some of the new technology that has been developed at several U.S. national laboratories and in industry is summarized. Superconducting wire with high J/sub c/ and filaments as small as 5μm diameter is now produced with mechanical properties suitable for reliable cable production. A variety of collar designs of both aluminum and stainless steel have been

used in model magnets. A low-heat leak post-type cryostat support system is used and a system for accurate alignment of coil-collar-yoke in te cryostat has been developed. Model magnets of 1-m, 1.8 m, 4.5 m, and 17 m lengths have been built during the past two years.

20404 **Performance of initial full-length RHIC dipoles.** Dahl, P.; Cottingham, J.; Garber, M.; Ghosh, A.; Goodzeit, C.; Greene, A.; Herrera, J.; Kahn, S.; Kelly, E.; Morgan, G. (Brookhaven National Lab., Upton, NY (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 723-725(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The first four full-length (9.7 m) R and D dipoles for the proposed Relativistic Heavy Ion Collider (RHIC) have been successfully tested. The magnets reached a quench plateau of approximately 4.5 T with very reasonable training - a field level comfortably above the design field of 3.45 T required for operation with beams of 100 GeV/amu gold nuclei. Measured field multipoles are considered to be quite acceptable for this series of R and D magnets.

20405 **Use of tapered key collars in dipole models for the SSC.** Peters, C.; Mirk, K.; Wandesforde, A.; Taylor, C. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 820-822(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Three one-meter SSC type dipole magnet models have been constructed and tested using tapered keys to lock interleaving aluminum alloy collars around the coils. This design enables the coil prestress to be created by hoop tension in the collars as the keys are pressed in. This method minimizes the high coil overstress required to insert traditional non-tapered keys. In particular, collaring may be accomplished without exceeding 10,000 psi coil pressure while producing in excess of 7,500 psi coil pressure after collaring. Significantly, this design enables aluminum collars to be used with their advantage of maintaining coil prestress during cooldown. Coil prestress measured during and after the collaring of the three one-meter models will be given. A description of the design, including FEA analysis, and the forces required to key the collars, will be given.

20406 **Concepts for the design of magnets at target locations subjected to very high radiation levels.** Otter, A.; Hojvat, C. (TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C. V6T 2A3 (CA)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 847-850(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Magnets for advanced hadron facility secondary beam lines will be positioned close to targets at which nuclear radiation levels will be about 10/sup 8/ rad/h. New designs are proposed in which the magnet coils are remote from the beam apertures and are shielded from radiation by the poles or other non-magnetic shielding material. The magnet yokes and poles are integrated into the radiation shielding surrounding the targets. If necessary, the coils can be removed for servicing without exposing the parts of the magnet with very high residual radiation fields. it will also be necessary to have vacuum joints adjacent to the magnets because the parts of the magnet close the to the beam tube should never have to be removed for maintenance.

20407 **Injection septum magnets for the Loma Linda medical accelerator.** Satti, J.A. (Fermi National Accelerator Lab., Batavia, IL (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 859-861(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The injection beamline runs over the last magnet before a long straight section and is then displaced downward 55.88 cm to the accelerator beam- line. The displacement is magnetic and the final deflection onto the synchrotron orbit is by an electric kicker. The first component, the reverse septum magnet, bends the injection beam 25° downward. This is followed by the injection septum (20° bend upward) and the final injection kicker (5° bend upward). The septum magnets produce a peak field of 3.4 K gauss at a current of 28,000 amperes within a 0.1 msec long pulse. The electric kicker produces a field of 7.3 KV/cm with a pulse length of 0.0011 msec. The septum magnets are similar to each other in construction with a bending radius of 72.7 cm. The curvature is required to increase the effective aperture. Each magnet has a single-turn copper coil bonded to a stainless steel plate for reinforcement. This eliminates insulating material, which could be subject to radiation damage, at the septum. The stainless steel plate is welded to the magnet laminations. The current is confined to the septum by the insulation between the laminations, which are a standard core material. The total septum thickness with shield is 1.27 cm. Pulsing the magnet eliminates the need for water cooling.

20408 **Magnetic measurement system for harmonic analysis of LBL SSC model dipoles and quadrupoles.** Green, M.I.; Barale, P.J.; Gilbert, W.S.; Hessenzahl, W.V.; Nelson, D.H.; Taylor, C.E.; Travis, N.J.; Van Dyke, D.A. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 958-961(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Specialized hardware and software have been developed to facilitate harmonic error analysis measurements of one-meter-long Superconducting Super Collider (SSC) model dipole and quadrupole magnets. Cold bore measurements feature cryogenic search-coil arrays with high buckling ratios that also have sufficient sensitivity to make room-temperature measurements at the low magnet currents of —10 A. Three sets of search coils allow measurements of the center, either end, and/or the axially integrated field. Signals from the search coils are digitally integrated by means of a voltage-to-frequency converter feeding an up-down counter. The data are drift corrected, Fourier analyzed, converted to physical quantities, and printed and plotted. A cycle of measurements including data acquisition, processing, and the generation of tabular and graphic output requires 80 seconds. The vast amount of data generated (several hundred cycles for each magnet) has led to the development of postprocessing programs and procedures. Spreadsheets allow easy manipulation and comparison of results within a test series and between magnets.

20409 **The magnetic properties of the SLC intersection region superconducting quadrupole triplets.** McInturff, A.D.; Carson, J.A.; Fisk, H.E.; Erickson, R.A. (Fermi National Accelerator Lab., P.O. Box 500, Batavia, IL (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1268-1271(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The measured magnetic field parameters of the quadrupoles which comprise the final triplet lens system for the SLAC Linear Collider intersection region are presented here. The minimum design gradient specifications for these quadrupoles are 1.7T/cm at 4.6K and 1.6T/cm at 4.6K in a 0.6T external solenoidal field. These gradients are about three times larger than those available with the conventional iron/copper quadrupoles now used in the SLC. Superconductivity quadrupoles of two lengths have been specified for the SLC triplets. The effective magnetic length of type Q/sub 1/ is 66.498 +- 0.305cm and of Q/sub 2/ is 121.106 +- 0.61 cm. The superconducting performance characteristics of the quadrupoles that have been measured are: maximum critical current as a function of bath temperature, rate of change of magnetic field, and a a percentage of the "short sample". "Short sample" performance is defined as the current reached by the cable in a perpendicular magnetic field equal to the peak field in the winding at bath temperature. The maximum gradient achieved during testing was 2.04T/cm (4.25K) and 2.07T/cm (3.2K). This represented 95% of the strand critical current value. The magnetic length of the first Q/sub 2/ was measured to be 120.85 +- .1 cm. The Fourier harmonic coeffi-

cients of the magnetic field were measured as a function of current and are reported.

4304 Storage Rings

REFER ALSO TO CITATION(S) 20359, 20386, 20387, 20388, 20389, 20390, 20391, 20393, 20394, 20395, 20396, 20397, 20398, 21066, 21153

20410 **(DOE/FTR—9008099) [14th meeting of the HERA Machine Committee, Hamburg, West Germany, October 30, 1988--November 3, 1988]: Foreign trip report.** Reardon, P.J. (Brookhaven National Lab., Upton, NY (USA)). 2 Mar 1989. Contract AC02-76CH00016. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008099/JAW.

The traveler attended the 14th Meeting of the HERA Machine Committee that was held on November 1-3, 1988 at DESY Laboratory in Hamburg, West Germany. This meeting consisted of discussions and general progress report. Some of the topics covered were: Startup of the E-Ring, work and changes needed for the Injection Chain, plan for the next E-run, Helium Distribution System, general progress report on PETRA, report on transverse performance limitations, Proton RF, status of polarization, and a general discussion centering on the further development and commissioning of the proton injector chain.

20411 **(GSI—89-06-Prepr.) RF linac and storage ring - perspectives of heavy ion fusion studies at GSI.** Hofmann, I. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1989. 13p. (CONF-8806101—). Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

After many years of theoretical studies of the rf linac/storage ring scenario, we are now at GSI close to the completion of a two-ring accelerator complex, which will allow unique contributions to the development of HIF owing to its high operational flexibility. The availability of a high-current injector, together with charge stripping and beam cooling allows to simulate by experiment nearly all crucial questions that can be raised for a full-scale driver accelerator based on conventional technology. The high intensity development of SIS/ESR will be beneficial to target experiments in the range of a few kilojoule beam energy. From theoretical estimates with electron-cooled Xe beams we predict temperatures in solid gold of 20 eV average or 50 eV at the end of range. After this goal has been reached, plans for future development into the range of temperatures exceeding 100 eV (when radiation effects become significant) could go along of temperatures exceeding 100 eV (when radiation effects become significant) could go along one of the following directions: A more conventional approach that requires a stack of 6 additional rings in a common tunnel of 10 m radius; or only one such additional ring but with non-Liouvillian pulse stacking through a stripping foil. Problems to be studied in the future are briefly outlined.

20412 **(INFN/AE—87-4) Considerations on installing a strong solenoid in a low energy storage ring.** Kewisk, J.; Rossmanith, R.; Kreiser, H.; Niinikoski, T.; Penzo, A.; Onel, Y. (Continuous Electron Beam Accelerator Facility, Newport News, VA (USA); Hamburg Univ. (Germany, F.R.); Geneva Univ. (Switzerland); Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705497/JAW.

Recently a method was proposed to polarize the stored antiprotons in LEAR. Particles with different spins are separated by a device called spin-splitter consisting of skew-quadrupoles and a strong solenoid. In this paper it is shown in principle that the spin splitter with its strong solenoid field can be integrated into a low energy storage ring such as LEAR, without long changes in optics.

20413 **(NIKHEF-K-LINO—158) Literature search on Kickers and Septa for the Amsterdam Pulse Stretcher.** Kuijt, J.; Linden, A. v.d. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 1988. 32p. (In Dutch). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706115/JAW.

Literature search has yielded a qualitative and quantitative view on kickers. Quantitatively specifications on designs in literature have been collected. The UPDATE-kickers have been given the following specs: deflection angle 2 mrad, pulsewidth 2 μs, falltime 70 ns, available length about 2 m. Undertaken is a comparison of characteristic parameters: kick strength (energy x angle), pulse characteristics (pulsewidth/falltime) and required peak power. Realisation of the pulse characteristics will impose the greatest requirements on the UPDATE-kicker design. The comparison has shown correspondence with two ferrite kicker designs (CERN-CPS and ELSA), the Los Alamos TEM-kicker and the electrostatic kicker from Saskatoon. On account of the relative simplicity of construction and pulse forming network the Saskatoon kicker has been chosen as the starting point for a design study. Design calculations will proceed from a length of 1.6 m and a gap of 4 cm between two parallel plates at a potential difference of 50 kV. Literature search on septa resulted in an overview on septum magnets and electrostatic wire septa. 72 refs.; 14 figs.; 2 tabs.

20414 (SLAC—316, pp 37-46) **Storage rings, internal targets and PEP.** Spencer, J.E. May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Most of the talks here will be on physics from accelerators and storage rings rather than the physics of such systems since the physics is hard enough without having to worry about the beams or how you get them. As a result, this remains transparent to the user via an equipartition of effort worthy of a business school. This is especially debatable for colliding beam storage rings and leads to the corollary that most rings will be born, live and die as dedicated systems. SPEAR is a notable exception while PEP is not - even though PEP seems to provide more unique opportunities over a broader spectrum of physics. Examples include one and two photon physics with real and virtual photons to make all J/sup PC/ quark combinations as well as high luminosity QCD confinement studies with internal targets as discussed at this workshop. Some related possibilities include external beams of high energy photons; single-pass, free-electron lasers and x-ray synchrotron radiation which could all be the highest energy, resolving power, intensity and brilliance anywhere. From the viewpoint of accelerator physics, such examples fall into three categories: colliding beam physics, internal and external target physics.

20415 **Correction of the field in the SSC dipoles using superconductor on the wedges.** Green, M.A.; Talman, R.M. (Lawrence Berkeley Lab., Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 823-826(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The SSC colliding beam storage ring requires superconducting magnets capable of producing a magnetic field of 6.6 T which has very high accuracy. For many of the multipoles, that multipole must be reduced (at a radius of 1 centimeter) to the order of 0.2 parts in 10,000. This field accuracy is dictated by the physics of storing very small high-current proton beams at energies ranging from 1 TeV to 20 TeV. Magnetization of the superconductor can cause sextupole field errors of up to 6 parts in 10,000 at an injection field of 0.33 T at a radius of 1 centimeter. Saturation of the magnet iron can induce sextupole field errors of 1 to 2 parts in 10,000 at the full field of 6.6 T. Manufacturing errors can induce other multipole components, both normal and skew. The SSC coil has three wedges separating the superconducting coil blocks on the inner layer of the coil. These wedges must be accurately located. If the wedges have superconductors attached, one can correct all of the magnetic field multipoles (both normal and skew) from N=1 (dipole) to N=6 (12 pole). This paper describes this method of correction as it pertains to the SSC dipole magnet.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 20045, 20318, 20381, 20881, 20919, 20985, 20997, 21008, 21194, 21315, 21329, 21373, 21531, 21582

20416 (AERE-R—12749) Measurements on the 3280 Alpha-in-Air monitor compensated pulse output. Beddow, A.J.M. (UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.). Jun 1987. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705954/JAW.

The use of computer signal processing techniques allows more reliable measurements to be made from sources that have a high level of noise present in the measurement. This report details an investigation made into the noise characteristics of the 3280 Alpha-in-Air monitor, prior to the development of an algorithm to process such measurements in computer-based Environmental Monitoring Systems.

20417 (BNL—41933) Challenge in reaching 10/sup {minus}7/ precision: Magnetic field, counters and hadronic contribution. May, M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-8805267—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007078/JAW.

From g-2 workshop; Hakone, Japan (30 May 1988).

Determining the muon magnetic moment anomaly, a/sub μ/, to .35 ppM will open a window on physics at a mass scale which is not now accessible to high energy experiments. Measurements of magnetic field and spin precession frequency free from systematic error at the 10/sup {minus}7/ level are required to attain this goal. Approaches to these problems are discussed. A novel method of precision measurement of magnetic field using the cyclotron frequency of heavy ions is outlined. To fully utilize the great experimental precession of the planned measurements of a/sub μ/, knowledge of the hadronic contribution to a/sub μ/ must be improved. The status of experiments leading to such an improvement is reported. 14 refs. 3 figs.

20418 (BNL—52185) Proceedings of the third workshop on experiments and detectors for a relativistic heavy ion collider (RHIC). Shivakumar, B.; Vincent, P. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 194p. (CONF-880707—). NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008843/JAW.

From 3. workshop on experiments and detectors for a relativistic heavy ion collider (RHIC); Upton, NY, USA (18 Jul 1988).

This report contains papers on the following topics: the RHIC Project; summary of the working group on calorimetry; J/{Psi} measurements in heavy ion collisions at CERN; QCD jets at RHIC; tracking and particle identification; a 4π tracking spectrometer for RHIC; Bose-Einstein measurements at RHIC in light of new data; summary of working group on read-out electronics; data acquisition for RHIC; summary of the working group on detector simulation; B-physics at RHIC; and CP violation revisited at BNL, B-physics at RHIC.

20419 (CONF-890268—1) Piezoelectric dosimeter charger development. Thacker, L.H. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007524/JAW.

From Joint service radiac working group meeting; Albuquerque, NM, USA (21 Feb 1989).

Piezoelectric dosimeter chargers certainly are not new. They have been around for somewhere between one and three decades. A study of the FEMA charger designs to see if significant cost reductions might be possible without any compromise in the function of the chargers was undertaken. It was found that the existing designs were functionally very acceptable, but that the costs were significantly increased by three factors: requirements for precision machined components; a relatively complicated assembly process; and failure to make optimum use of equivalent commercially available components instead of calling for custom designed and fabricated parts. By careful attention to these factors a modified design was developed which reduced parts costs by an estimated $134 per unit (from $198 to $64), with near identical form, operation, and function; in addition, estimated assembly costs were greatly reduced.

20420 (CRN-HE—88-02) Study and realisation of a multiwire chamber with flat cathodes and partitions for the RICH barrel of DELPHI. Husson, D. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1987. 194p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88757195/JAW.

The construction of a Cherenkov detector (RICH) for the DELPHI spectrometer of the LEP electron-positron collider is described. The Cherenkov effect is used in a double system of liquid and gas radiators to identify charged particles in jets. The imaging technique requires 3D localisation of individual electrons, so the RICH detectors are fine grain multiwire chambers, with anode and cathode readout. The chamber geometry includes flat cathodes, optical insulation of each anode (to avoid secondary emission phenomena) realised by a system of aluminium partitions. Chamber design was based on electrostatic simulations to establish absolute collection efficiency in a magnetic field in the presence of these dielectric partitions, and to study the best conditions for blocking the chamber. A prototype was tested in UV light, then in a pion beam: it enabled the Cherenkov rings from a gas radiator to be reconstructed, with good performance as to the resolution of the Cherenkov angle, the efficiency of the cathode, and the figure of merit of the detector.

20421 (CTA-IEAV-NT—06/86) Proton an alpha detections by track recording technique in CR-39. Oliveira, W.A. de; Franco, M.A.R.; Herdade, S.B.; Khouri, M.C.F.; Goncalez, O.L. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Jul 1986. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705418/JAW.

The plastic CR-39 is utilized as proton track detector in the study of the reaction /sup 27/A (e, p) and /sup 59/Co (e, p), near threshold. Preliminary results are presented for the energy calibration (mean track diameter as a function of proton energy) of CR-39 with mono-energetic protons of a Van de Graaff accelerator, in the energy range 1-3 MeV.

20422 (ICEFIZ-LOP—61-1988) Photoelectric detectors used in laser based control and alignment equipment. Chis, I.; Ciura, A.I.; Udrea, M.V. (Institutul de Fizica si Tehnologia Aparatelor cu Radiatii, Bucharest (Romania)). (Central Inst. of Physics, Bucharest (Romania)). Mar 1988. 15p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706010/JAW.

Some theoretical considerations and practical results regarding the utilization of the ROL 50 photovoltaic cell in a leveling control system and glass quality control equipment are presented. (authors).

20423 (INDC(CCP)—285/GR) Neutron dosimetry system SAIPS: Manual for users and programmers (Version 87-02). Berzonis, M.A.; Bondars, Kh.Ya.; Niedritis, A.M. (Latvijskij Gosudarstvennyj Univ., Riga (USSR)). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1988. 38p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706053/JAW.

Translated from Russian.

SAIPS is a system used for neutron dosimetry by foil activation, containing a package of programs and a data base of neutron activation cross-sections. A description is given of the SAIPS indexed procedures and users language, which are designed for producing input data for programs unfolding neutron spectra from reaction rate measurements, for carrying out calculations and processing and comparing the results obtained, for utilizing the additional capabilities of the system, and for setting up a working version of the system from the magnetic tapes used for distribution. A descrip-

tion is given of the logical structure of the data sets containing the libraries of neutron cross-section and a priori spectra and also the libraries of calculated spectra. The annexes give examples of SAIPS in use, of the contents of the a priori spectra and neutron cross-section libraries, and of the contents of the SAIPS distribution tapes. SAIPS contains programs in PL/1 (opt), FORTRAN IV(H) and ASSEMBLER. 25 refs.

20424 (INFN/AE—88-7) **Scintillating optical fibers in detection of X synchrotron radiation images.** Zanella, G.; Zannoni, R. (Istituto Nazionale di Fisica Nucleare, Padua (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 10p. (In Italian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705498/JAW.

It is pointed out how the use of optical fiber matrices (or alluminated optical guides) of scintillating glass can constitute systems of X image detection with energy higher than 2 KeV, with high efficiency, high spatial resolution and an acquisition capability dependent on the X flux, in the formation of the single images.

20425 (INIS-BR—1411, pp 191-196) **Field dose rate measurement by mobile equipment.** Kirchhoff, K. (Lower Saxonoy State Office for Immission Protection, Hannover (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

In the environment of most nuclear installations in German rings of automatic dose rate meters are installed to give information even when the meters at the stack are overload. In order to reduce the number of devices needed and the costs of maintenance it is discussed to use in somes cases mobile dose rate meters equipped with radio transmitters. These should be brought to certain places and switched on just in case of emergency.

20426 (INIS-BR—1411, pp 173-178) **Meteorological information system for nuclear installations.** Huebschmann, W.G. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Meterologie und Klimaforschung). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Meteorological Information Systems (MIS) at nuclear installations serve the following purposes: measuring and recording of actual meteorological data in order to assess the disperson of radioactive pollutants being released under incidental or accidental circunstances; - long-term recording of the meteorological data for the assessment and control of the dose equivalent received by the population in the vicinity of the light. A proposed German guideline specifies the instruments and the equipmemt being necessary to determine the parameters of the dispersion of atmospheric pollutants: wind direction and velocity, dispersion category and precipitation. The knowledge of the applicable dispersion parameters is presumed. The instrumentation of a meteorological tower to be installed at a nuclear installation is described, with a view on the system of data registration, processing and recording. A MIS to be erected at the CDTN site is shortly described.

20427 (INIS-BR—1411, pp 179-185) **Application of the liquid scintillation counting method in environmental monitoring.** Kirchhoff, K. (Lower Saxony State Office for Immission Protection, Hannover (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Liquid scintillation counting (LSC) was developed primarily for measurement of Tritium and Carbon-14 in biological and medical applications. The industrial delivered devices therefore are designed for automatical measurement of a greater number of spiked medium activity samples. The main advantage of LSL, the direct contact between nuclide and scintillator solution, may also be used for measurement of β and α emitting nuclides in environmental samples. In this case special sample treating and measurement procedures are necessary depending on the nuclide in question.

20428 (INIS-BR—1424, pp 11) **Construction of an extensive shower detector with energies higher than 10/sup 15/ e V in Campinas-Brazil.** Chinellato, J.A.; Fraguas, G.B.; Manganote, E.J.T.; Mengotti S, N.; Santos, L.G.; Souza Junior, M.C.; Tamura, E.; Turtelli Junior, A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20429 (INIS-mf—11356, pp 156) **Design, construction and installation of a sterilization dose measuring device.** Oryga, J.; Ostrowski, T. (Centre of Isotopes Production and Reactors, Institute of Atomic Energy, Reactors Analyses and Irradiation Technology Dept., Otwock/Swierk (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20430 (INIS-mf—11383) **Gas scintillation proportional detector for X-rays.** Okx, W.J.C. (Technische Univ. Delft (Netherlands)). 5 Apr 1988. 98p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88706081/JAW.

Includes Dutch summary.

The development of two gas scintillation proportional detectors with background suppression is described. The anti pp K X-ray experiment is described, being the only experiment yet done with these detectors. 53 refs.; 71 figs.; 8 tabs.

20431 (INIS-mf—11384) **Automation of a Guinier camera for X-ray diffraction.** Duijn, J.H. (Technische Univ. Delft (Netherlands)). 7 Jun 1988. 77p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88706082/JAW.

Includes Dutch summary.

The automation of a Guinier X-ray diffraction camera is discussed. The photographic plate in the conventional setup has been replaced by a curved proportional counter (CPC) which has an electronic readout system. As a result the recording time has been reduced from a few hours to a few minutes. The construction and optimum dimensions of the CPC are discussed and the most essential parts of the readout electronics are highlighted. A linewidth of 200 μm FWHM and an accuracy of 30 μm are achieved. 45 refs.; 53 figs.; 4 tabs.

20432 (INIS-mf—11386) **Photon detection in ring imaging Cherenkov counters.** Jansen, H. (Rijksuniversiteit Leiden (Netherlands)). 6 Oct 1988. 109p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706084/JAW.

Includes Dutch summary.

One of the parts of DELPHI (a detector at the CERN LEP) is the barrel-RICH which uses Cherenkov radiation to determine the velocity of charged particles; together with the measured momentum this information yields the mass of each particle. The performance of the photon detector, which determines to a large extent the analyzing power of the barrel-RICH, is studied. 98 refs.; 40 figs.; 6 tabs.

20433 (IPNO-DRE—87-33, pp 5-8) **Compact fast data acquisition and data analysis system for time of flight mass spectrometry. Time and S.I. intensity measurements with a new multistop TDC.** 1987. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW. (CONF-8705114—; CONF-8709132—; CONF-8709414—).

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

A data acquisition and processing system for time of flight mass spectrometry, based on a PC-AT computer with an additional

memory card was developed, and analysis software was written. About 100,000 counts/sec can be analyzed and stored in the memory. In the coincidence mode, 1000 start events with 10 stop events (per sec) on one time digital converter allow 10 spectra to be recorded. Examples of printouts are shown.

20434 (IPNO-DRE—87-33, pp 9-12) **Pulsed Cs ion gun for time of flight mass spectrometry.** 1987. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW. (CONF-8705114—; CONF-8709132—; CONF-8709414—).

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

A pulsed ion gun was built for surface analysis of organic and inorganic solid layers. Secondary ion mass analysis is made by time of flight measurements. In the spectrometer, MeV ions from a Cf252 source can also be used to bombard the same targets. The principle of the apparatus is similar to the Manitoba system (Standing et al, 1982), but the Cs ion source (Ionex) and the geometrical arrangement are different. Typical measurement results from experiments using the equipment are illustrated.

20435 (KFK—4444, pp 5-42) **Proportional counters: Physical and technical aspects, applications in radiation protection measurements.** Maushart, R. (Laboratorium Prof. Dr. Berthold, Wildbad (Germany, F.R.)). Sep 1988. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

Proportional counters are frequently considered to be just a kind of transition stage between an ionization chamber and a GM-counter. This view is mainly based on the presentation of pulse heights versus applied voltage that can be found in most text books. However, a closer look on the physical phenomena taking place in a counter tube reveals that the voltage is by no means the only criterion for the detector to be operating in the proportional or in the geiger region. This is, on the contrary, determined in practice by the creation and absorption of UV photons in the counting gas on the one hand, and by the release of electrons by ions arriving at the cathode on the other hand. These relations are being investigated in the first part. The results are applied to derive consequences for better construction and practical operation of proportional counters. In practical use proportional counters prove to be a quite original kind of radiation detector. The many possible variations of sizes and shapes, and the favourable operational properties have opened a broad field of applications in radiation protection measurements. This is shown in the second part, giving many specific examples. A short third part points out where the future development will be going.

20436 (KFK—4444, pp 69-93) **Phosphate glass dosemeter - the routine dosemeter for the future?.** Piesch, E. Sep 1988. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

In spite of the extraordinary dosimetric properties of phosphate glass dosemeters, the lack in an automatic read-out prevented retrospectively a large-scale application of glass dosimetry. New aspects of personnel monitoring were found by a commercially available fully automatic dosimetry system using pulsed UV laser excitation and a flat glass dosemeter for the measurement of the photon dose equivalent in the dose range of 10 μSv above a photon energy of 10 keV.

20437 (KFK—4444, pp 127-142) **In vivo measurement of transuranium radionuclides.** Doerfel, H.R. Sep 1988. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

In the Karlsruhe Nuclear Research Center the development of techniques for in vivo detection of transuranium radionuclides started about 30 years ago with the construction of high sensitive partial body counters. At first large area proportional counters with special anticoincidence techniques were used, later they were replaced by phoswich detectors. Based on experiences collected in the last years a new partial body counter is now under construction using Germanium telescope detectors. Objective of developments is the direct assessment of transuranium body burdens in the dose relevant tissues and the direct estimation of resulting doses, respectively.

20438 (KURRI-TR—303, pp 1-3) **High resolution crystal ball.** Inoue, H. (Hiroshima Univ. (Japan). Faculty of Science). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

20439 (KURRI-TR—303, pp 4-6) **Data acquisition and analysis system at Niels Bohr Institute.** Kuroyanagi, T. (Kyushu Univ., Fukuoka (Japan). Faculty of Science). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

20440 (KURRI-TR—303, pp 54-57) **Precise measurement of gamma-rays with bent crystals.** Yamada, S. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

20441 **(LBL—26500) Cerium fluoride, a new fast, heavy scintillator.** Moses, W.W.; Derenzo, S.E. (Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098;AC03-82ER13000. 8p. (CONF-881103—46). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007136/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We describe the scintillation properties of Cerium Fluoride (CeF_3), a newly discovered, heavy (6.16 g/cm^3), inorganic scintillator. Its fluorescence decay lifetime, measured with the delayed coincidence method, is described by a single exponential with a 27 {+-} ns time constant. The emission spectrum peaks at a wavelength of 340 nm, and drops to less than 10% of its peak value at 315 nm and 460 nm. When a 1 cm optical quality cube of CeF_3 is excited with 511 keV photons, a photopeak with a 20% full width at half maximum is observed at approximately half the light output of a Bismuth Germanate (BGO) crystal with similar geometry. We also present measurements of the decay time and light output of CeF_3 doped with three rare-earth elements (Dy, Er, and Pr). The short fluorescence lifetime, high density, and reasonable light output of this new scintillator suggest that it would be useful for applications where high counting rates, good stopping power, and nanosecond timing are important, such as medical imaging and nuclear science. 5 refs., 6 figs., 1 tab.

20442 **(LBL—26529) Initial characterization of a position-sensitive photodiode/BGO detector for PET [positron emission tomography].** Derenzo, S.E.; Moses, W.W.; Jackson, H.G.; Turko, B.T.; Cahoon, J.L.; Geyer, A.B.; Vuletich, T. (Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098. 9p. (CONF-881103—54). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007660/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We present initial results of a position-sensitive photodiode/BGO detector for high resolution, multi-layer positron emission tomography (PET). Position sensitivity is achieved by dividing the 3 mm {times} 20 mm rectangular photosensitive area along the diagonal to form two triangular segments. Each segment was individual-

ly connected to a low-noise amplifier. The photodiodes and crystals were cooled to {minus}100{degree}C to reduce dark current and increase the BGO signal. With an amplifier peaking time of 17 μsec, the sum of the signals (511 keV photopeak) was 3200 electrons with a full width at half maximum (fwhm) of 750 electrons. The ratio of one signal to the sum determined the depth of interaction with a resolution of 11 mm fwhm. 27 refs., 7 figs.

20443 **(NIKHEF-H—88-5) Electron drift velocity close to a sense wire.** Konijn, J.; Hartjes, F. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H; Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands); Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Jun 1988. 11p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706106/JAW.

Using a focused UV nitrogen laser beam, electrons were liberated from an argon-ethane gas mixture in a drift chamber. The drift time was measured for distances from the sense wire between 30 mm and 30 μm. From these measurements a drift velocity curve was derived for electric field strengths between 1 and 15 kV/cm. 6 refs.; 6 figs.

20444 **(NUREG/CR—5100) Integrating fiber optic radiation dosimeter.** Soltani, P.K.; Wrigley, C.Y.; Storti, G.M.; Creager, R.E. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Quantex Corp., Rockville, MD (USA)). Mar 1989. 49p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89008779/JAW.

The purpose of this research effort was to determine the feasibility of forming a radiation sensor coupled to an optical fiber capable of measuring gamma photon, x-ray, and beta particle dose rates and integrated dose, and to construct a prototype dosimeter read-out system utilizing the fiber optic sensor. The key component of the prototype dosimeter system is a newly developed radiation sensitive storage phosphor. When this phosphor is excited by energetic radiation, a proportionate population of electron-hole pairs are created which become trapped at specific impurities within the phosphor. Trapped electrons can subsequently be stimulated optically with near-infrared at approximately 1 micrometer wavelength; the electrons can recombine with holes at luminescent centers to produce a luminescence which is directly proportional to the trapped electron population, and thus to the radiation exposure. By attaching the phosphor to the end of an optical fiber, it is possible to transmit both the IR optical stimulation and the characteristic phosphor luminescence through the fiber to and from the read-out instrument, which can be located far (e.g., kilometers) from the radiation field. This document reports on the specific design of the prototype system and its operating characteristics, including its sensitivity to various radiation dose rates and energies, its dynamic range, signal-to-noise ratio at various radiation intensities, and other system characteristics. Additionally, the radiation hardness of the phosphor and fiber are evaluated. 17 refs., 29 figs., 5 tabs.

20445 **(TRI-PP—88-93) Fast tracking detector with fiber scintillators and a position sensitive photomultiplier.** Salomon, M.; Li, V.; Smith, G.; Wu, Y.S. (TRIUMF, Vancouver, British Columbia (Canada)). Nov 1988. 4p. (CONF-881103—53). NTIS (US Sales Only), PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007652/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We have studied the properties off a tracking detector composed of 32 fiber scintillators coupled to a multianode photomultiplier placed in a pion beam at TRIUMF. We measured the efficiency of the detector, as well as its tracking capabilities and double hit resolution. 8 refs., 6 figs.

20446 **(TRI-PP—88-94) Design of a volume-imaging positron emission tomograph.** Rogers, J.G.; Harrop, R.; Coombes, G.H.; Wilkinson, N.A.; Atkins, M.S.; Pate, B.D.; Morrison, K.S.; Stazyk, M.; Dykstra, C.J.; Barney, J.S. (TRIUMF, Vancouver, British Columbia (Canada)). Nov 1988. 5p. (CONF-881103—52). NTIS (US Sales Only), PC A02/MF A01 - OSTI. Order Number DE89007651/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

Progress is reported in several areas of design of a positron volume imaging tomograph. As a means of increasing the volume imaged and the detector packing fraction, a lens system of detector light coupling is considered. A prototype layered scintillator detector demonstrates improved spatial resolution due to a unique Compton rejection capability. The conceptual design of a new mechanism for measuring scattered radiation during emission scans has been tested by Monte Carlo simulation. The problem of how to use effectively the resulting sampled scattered radiation projections is presented and discussed. 12 refs., 6 figs.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 20476

20447 **(HMI-B—353(v.5,ed.2)) GfW-handbook for data compilation of irradiation tested electronic components. Vol. 5.** Boden, A.; Wulf, F.; Braeunig, D. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik; Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.). Bereich fuer Projekttraegerschaften; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1987. 802p. Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik.

Loose-leaf collection.

The 2nd edition of the 'Data compilation of irradiation tested electronic components' is a continuation of the 1st edition and is published as a loose-leaf handbook. The 1st edition contained 190 test reports. In the 2nd edition there have been published so far volume 1 through volume 4, containing 215 test reports. The present volume 5 of the 2nd edition provides further 84 test reports. These test reports of electronic components which are currently used in space projects have a standardized format. The results are given in a comprehensive but easily to handle graphical and tabular presentation. Statistical values are given in order to facilitate the components life time evaluation in a radiative environment.

20448 **(LBL—25062) Radiation effects on optical data transmission systems.** Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 12p. (CONF-881103—45). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007137/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

The state of the art of optical transmitters, low loss fiber waveguides and receivers in both steady state and pulsed radiation environments is reviewed and summarized. Emphasis is placed on the effects of irradiation on the performance of light emitting and laser diodes, optical fiber waveguides and photodiodes. The influence of radiation-induced attenuation of optical fibers due to total dose, dose rate, time after irradiation, temperature, radiation history, photobleaching, OH and impurity content, dopand type and concentration is described. The performance of candidate components of the transmission system intended for deployment in the Superconducting Super Collider Detector and primary beam tunnel nuclear environment is discussed. 17 refs., 15 figs.

20449 (ORNL/TM—10985) Shield optimization program: Part 3, Effects of x-ray radiation from nuclear weapons on SDI weapon platforms. Johnson, J.O.; Gabriel, T.A.; Barnes, J.M.; Drischler, J.D.; Smith, M.S.; Santoro, R.T. (Oak Ridge National Lab., TN (USA)). Mar 1989. Contract AC05-84OR21400. 68p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007868/JAW.

Initial studies have been completed to estimate the radiation induced damage to the silicon electronic components and other sensitive areas (fuel tanks) carried on a representative Space Based Interceptor (SBI) weapon platform. The SBI weapon platform model used in the studies represents the author's concept of such a system. The analysis was completed for the blackbody x-ray radiation environment emanating from a nuclear weapon detonation in space and considered blackbody temperatures in the range of 1 to 25 keV and exterior wall loadings in the range of 1 to 10 cal/cm^2. The results indicate the dose to the sensitive components within the exterior hull of the platform was insufficient to cause any damage at a 1 to 3 cal/cm^2 exterior wall loading. At higher (5 to 10 cal/cm^2) exterior wall loadings, some of the Kinetic Kill Vehicle (KKV) computers and sensors begin to receive doses sufficient enough to cause damage. The effects of shielding from within the platform architecture is seen by the different dose levels received in the KKVs and fuel tanks. Because of the low dose levels to the components within the exterior hull of the platform, no additional shielding is required for these components and for low exterior wall loadings. However, sensors and electronic components on the surface or outside of the exterior hull will require some form of x-ray shielding to survive the effects of a nuclear weapon detonation yielding a wall loading of 1 cal/cm^2 or greater. All of the calculations were carried out for an unshielded SBI weapon platform to determine the radiation levels for which shielding must be designed to insure survivability of the electronic systems. 6 refs., 11 figs., 22 tabs.

20450 (UCID—21649-Vol.3) Workshop on models to estimate military system probability of effect (P/sub E/) due to incident radiofrequency energy: Volume 3, Written inputs from reviewers and other participants. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 58p. (CONF-8806324—Vol.3). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008207/JAW.

From Workshop on models to estimate military system probability of effect (PE) due to incident radiofrequency energy; Washington, DC, USA (14 Jun 1988).

The workshop on Models to Estimate Military System P/sub E/ (probability of effect) due to Incident Radio Frequency (RF) Energy was convened by Dr. John M. MacCallum, OUSDA (R&AT/EST), to assess the current state of the art and to evaluate the adequacy of ongoing effects assessment efforts to estimate P/sub E/. Approximately fifty people from government, industry, and academia attended the meeting. Specifically, the workshop addressed the following: (1) current status of operations research models for assessing probability of effect (P/sub E/) for red and blue mission analyses; (2) the main overall approaches for evaluating P/sub E/'s; (3) sources of uncertainty and ways P/sub E/'s could be credibly derived from the existing data base; and (4) the adequacy of the present framework of a national HPM assessment methodology for evaluation of P/sub E/'s credibility for future systems. 9 figs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 19700, 20210, 20373, 20385, 20665, 20950

20451 (DOE/ER/10635—T3) The glow discharge as an atomization and ionization device: Final progress report, May 1, 1985--August 31, 1987. Harrison, W.W. (Virginia Univ., Charlottesville (USA). Dept. of Chemistry). 1987. Contract AS05-80ER10635. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007972/JAW.

Brief summaries are given for the primary project, glow discharge mass spectroscopy (GDMS), and the spin-off projects, resonance ionization mass spectrometry and hollow cathode plume atomic emission and mass spectroscopy. Major attention in glow discharge mass spectrometry centered on metals/alloys and powders requiring compaction. Glow discharge factors that affect or control the ion response of the samples were studied. Resonance ionization of the glow discharge was included to reduce or eliminate spectral interferences in GDMS. The hollow cathode plume was used in the analysis of metal alloys. 12 figs., 1 tab. (WRF)

20452 (DOE/FTR—9006113) [Sixth conference meeting on optical engineering and presentation of paper "All-optical modulation in gallium arsenide integrated optical waveguides," Tel Aviv, Israel, December 19--21, 1988]: Foreign trip report. McWright, G.M. (Lawrence Livermore National Lab., CA (USA)). 25 Jan 1989. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006113/JAW.

Dr. Glen McWright is Project Engineer, Electro-optics in the Optical Electronics Group in the Engineering Research Division. His responsibilities include directing, supervising, and coordinating a 5 FTE integrated optical device team. The purpose of this travel was to attend and present a paper entitled "All-Optical Modulation in Gallium Arsenide Integrated Optical Waveguides," (UCRL-98368) at the Sixth Meeting in Israel on Optical Engineering (Tel Aviv, Dec. 19--21, 1988). This conference is one of the premier international forums for the communication of optical engineering research results. Details of the afore mentioned trip are summarized in the following paragraphs.

20453 (ICEFIZ-LOP—65-1988) Industrial processes control with He-Ne laser devices for aligning and guiding. Ursu, I.; Ivascu, M.; Vasiliu, V.; Ristici, M.; Gradisteanu, I.; Vilcu, G.; Pelle, V.; Botezatu, I.; Vasnea, V.; Orac, N. (Institutul Central de Fizica, Bucharest (Romania); Combinatul Siderurgic Galati, Galati, Romania; Ministerul industriei de utilaj greu, Bucuresti, Romania; Antrepriza constructii hidroenergetice forari galerii puturi, Tarnita-comuna Gilau, judetul Cluj, Romania; Intreprinderea de constructii navale Constanta, Constanta, Romania). (Central Inst. of Physics, Bucharest (Romania)). Mar 1988. 38p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706013/JAW.

A brief presentation of the He-Ne laser devices main application fields in the national economy is given. The utilization of the devices we did in: industrial constructions, metalurgy, hydroelectric arrangements, wood industry, ship's construction, and other is presented. (authors).

20454 (IPNO-DRE—87-33) Ion-surface interactions. Della-Negra, S.; Deprun, C.; Le Beyec, Y.; Bolbach, G. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1987. Vp. (CONF-8705114—; CONF-8709132—; CONF-8709414—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW.

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

Individual papers are indexed.

20455 (LBL—25168) Low smear CCD camera for high frame rates. Turko, B.T.; Yates, G.J. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098;W-7405-ENG-36. 7p. (CONF-881103—42). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007080/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A small versatile CCD camera is described. Frame readout times from one second to milliseconds can be changed continuously or at random by a programmable clock. A very large range of light intensity is thus covered without the need for a mechanical aperture control. The camera can be reset at any time and then restarted at a different frame rate after the pause of a selected duration. Sony, Inc. ICX016AL sensor was found especially suitable for clock rates up to 50 MHz. Image smear, blooming and noise are substantially lower than in earlier interline transfer CCD sensors. Critical circuits are also described and measured data presented. 5 refs., 8 figs.

20456 (N—89-14154, pp 130-178) **Characterization of a turbomolecular-pumped magnetic sector mass spectrometer.** Mehta, N.K. Oct 1988. NTIS, PC A24/MF A01. (NASA-CR—183406; NAS—1.26:183406).

In NASA/ASEE Summer Faculty Fellowship Program: 1988 research reports.

A Perkin Elmer MGA-1200, turbomolecular-pumped, magnetic sector, multiple gas analyzer mass spectrometer with modified inlet for fast response was characterized for the analysis of hydrogen, helium, oxygen and argon in nitrogen and helium background gases. This instrument was specially modified for the Vanderberg AFB SLC-6 Hydrogen Disposal Test Program, as a part of the Hydrogen Sampling System (H2S2). Linearity, precision, drift, detection limits and accuracy among other analytical parameters for each of the background gas were studied to evaluate the performance of the instrument. The result demonstrates that H2S2 mass spectrometer is a stable instrument and can be utilized for the quantitative analytical determination of hydrogen, helium, oxygen and argon in nitrogen and helium background gases.

20457 **(PNL—6811) Rotationally sampled wind characteristics for several rotor sizes using laser anemometer measurements.** Connell, J.R.; Morris, V.R. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 60p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007942/JAW.

The concept of measuring the wind velocity rotationally around crosswind circles using a circle-scanning Doppler laser anemometer is investigated to determine the technique's suitability as an effective, simple, economical, and nonintrusive method for estimation turbulence at a wind turbine rotor. Estimates of wind features obtained using the lidar technique are compared to actual wind measurements obtained using a vertical plane array of anemometers, and to other estimates generated using a single-tower technique. Although the lack of a common data set precludes a firm conclusion regarding the lidar method's accuracy, it appears that the rotationally scanning lidar has the potential of becoming an excellent tool for measuring turbulent wind around the disk of rotation of a turbine blade. 11 refs., 21 figs., 2 tabs.

20458 **(RAL—88-103) High resolution powder diffractometer at ISIS - an introductory user's guide.** David, W.I.F.; Akporiaye, D.E.; Ibberson, R.M.; Wilson, C.C. (Rutherford Appleton Lab., Chilton (UK)). Dec 1988. 168p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706129/JAW.

This manual is intended to fulfil the role of an introductory users' guide for High Resolution Powder Diffractometer (HRPD). We hope, in addition to providing a general overview of the machine, that the manual will help users to run the instrument routinely and handle most aspects of data assessment and analysis. The contents are divided into six sections including: HRPD at ISIS, the experimental running of HRPD, Neutron Powder Diffraction data analysis at ISIS-practical and scientific aspects, data assessment and crystal structure plotting programs.

20459 **(TRI-PP—88-97) Tests of wire chamber ageing with CF_4/isobutane (80:20), argon/ethane (50:50), and argon/ethane/CF_4 (48:48:4).** Openshaw, R.; Henderson, R.; Faszer, W.; Murphy, D.; Salomon, M.; Sheffer, G. (TRIUMF, Vancouver, British Columbia (Canada)). Nov 1988. 5p. (CONF-881103—51). NTIS (US Sales Only), PC A02 - OSTI. Order Number DE89007650/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

In a series of parallel tests the aging characteristics of CF_4/isobutane (80:20), argon/ethane (50:50), and argon/ethane/CF_4(48:48:4) have been investigated. Parameters such as flow rate, gas gain, anode wire current density, and materials in contact with the gas stream have been varied. Some tests have been extended beyond 8 Coulomb/cm of wire. The Ar/Et chambers have shown a high incidence of pulse height degradation, dark currents, cathode foil etching and deposits on the electrodes. A strong correlation between anode wire current density and rate of damage (%/C/cm) is indicated for Ar/Et chambers. The CF_4/Iso chambers have shown effectively zero pulse height degradation and few other problems to accumulated charges exceeding 5 C/cm, except for one low-flow chamber with some cathode etching and cathode related pulse height degradation. The addition of 4% CF_4 to the Ar/Et mixture has dramatically improved the aging performance of the Ar/Et/CF_4 cells. 11 refs., 9 figs., 2 tabs.

20460 **Minimum dc electric field requirements for removing powder layers from a conductive surface.** Novick, V.J.; Hummer, C.R.; Dunn, P.F. (Engineering Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Applied Physics;* **65**: No. 8, 3242-3247(15 Apr 1989).

An electrostatic powder dispenser was constructed to dispense particles without the use of a carrier gas. This device consisted of two contoured, outer stainless-steel plates that were electrically grounded and a flat, inner copper grid that was electrified and contained a central powder reservoir. Experiments were performed to investigate the levitation of various powders from the reservoir in the presence of an applied dc electric field. Eleven materials including metals, oxides, and conductively coated oxides were studied under vacuum and atmospheric conditions. The electric field required to remove particles from the powder reservoir was found to be a function of particle density and size. An equation was developed that predicted the minimum voltage necessary to remove conductive particles larger than 10 μm in diameter from a conductive surface in a vacuum environment: E = [4.85(rhoD)/sup 1/2/ +0.362] x 10^5 , where E is the field strength (V/m), rho is the particle density (kg/m^3), and D is the mass median particle diameter (m). For particles in this size range, gravitational and electrostatic forces appeared to dominate, whereas for particles with a mass median diameter less than 10 μm, adhesive forces appeared to dominate. This equation was also found to hold for the removal of glass beads in air. A semiquantitative model was developed that was consistent with experimental results. This model calculated the force and charge induced on the particles in an electric field while taking into account the neighboring particles.

20461 **Computer-aided data-acquisition system for thermal gradient mapping and calibrations of high-temperature cavities.** Lutz, W.N.; Gillies, G.T.; Allison, S.W. (Department of Nuclear Engineering and Engineering Physics, University of Virginia, Charlottesville, Virginia 22901). *Review of Scientific Instruments;* **60**: No. 4, 673-682(Apr 1989).

We have designed, built, and tested a robust, thermocouple-based furnace calibration system having automated data acquisition and processing. The system can be used to produce maps of the thermal fields and gradients inside high-temperature cavities. The apparatus consisted of nine type K thermocouples mounted in a ceramic frame, an analog-to-digital interface board, a computer, NBS traceable calibration instrumentation, and software coded specially for the data acquisition and reduction. The absolute accuracy of the system was +- 1.3 °C up to 300 °C, providing that the thermocouples had not previously been exposed to temperatures higher than that. The resolution of its gradient sensing ability was +- 0.02 °C mm^{-1}. We present details of its construction and operation, a front-to-back error analysis, and results of its use with a box furnace operated between 50 and 1200 °C.

20462 **Extraction of secondary electrons in a newly proposed immersion lens.** Shao, Z. (Department of Physics and Enrico Fermi Institute, University of Chicago, 5640 South Ellis Avenue, Chicago, Illinois 60637). *Review of Scientific Instruments;* **60**: No. 4, 693-699(Apr 1989).

An analysis is given of a symmetric secondary electron extraction system suitable for use in a newly proposed immersion lens. The detailed behavior of secondary electrons in the combined electrostatic and magnetic field is presented. Numerical results show that this extraction system imposes very small effects on the primary electrons yet retains a high collection efficiency on secondary electrons, so that the advantages of the low aberration immersion lens can be fully utilized.

20463 Wide range temperature compensated cryogenic scanning tunneling microscope. Burger, J.; Meepagala, S.C.; Wolf, E.L. (Department of Physics, Polytechnic University, Brooklyn, New York 11201). *Review of Scientific Instruments;* **60**: No. 4, 735-738(Apr 1989).

We describe a compact scanning tunneling microscope using piezoelectric bimorph elements to achieve a large scanning area of 20 μm^2 at 4.2 K. This instrument provides inherent temperature compensation, compatibility with a high magnetic field environment, and a novel means of rough sample—tip (z) adjustment.

20464 Minimization of discrimination jitter in time-correlated single photon counting. Anfinrud, P.A.; Struve, W.S. (Department of Chemistry and Ames Laboratory-USDOE, Iowa State University, Ames, Iowa 50011). *Review of Scientific Instruments;* **60**: No. 4, 800-800(Apr 1989).

Instrument function widths in time-correlated single photon counting are minimized by adapting a commercial constant-fraction discriminator for essentially jitter-free processing of anode pulses from a Hamamatsu R1564U microchannel plate photomultiplier. This modification yields an instrument function with 47 ps FWHM, limited chiefly by photomultiplier transit-time spread.

20465 Efficiency enhancements for Fabry-Perots used in velocimetry. McMillan, C.F.; Parker, N.L.; Goosman, D.R. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Applied Optics;* **28**: No. 5, 826-827(1 Mar 1989).

This Letter discusses the premise that using a Fabry-Perot for velocity measurements wastes most of the energy in arriving at the input mirror and suggests a way to use more of the energy.

20466 Thermodynamics infrared imaging sensor. Metcalf, T.W.; Moran, S.E. (to Secretary of the Navy, Washington, DC). US Patent 4,788,428. 29 Nov 1988. Filed date 4 Mar 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an infrared imaging system wherein a visual image of a viewed scene is obtained from thermal energy radiated from the scene. The system consists of: means for receiving and focusing infrared radiation from a viewed scene. The focusing of the radiation occurring at an image plane; means located at the image plane for absorbing and thermo-dynamically converting the focused radiation into a measureable physical change of the absorbing means; means connected to interact with the means for absorbing for measuring the physical change of the absorbing means, the means for measuring outputting a signal which represents the physical changes occurring over the entire image plane; and means for processing and visually displaying the signal output from the means for measuring, wherein the visual display is a two-dimensional representation of the image of the scene being observed; wherein the means for measuring comprises an interferometer system which compared changes in phase between a reference beam and a signal beam of light which is reflected from the means for absorbing.

20467 Rotatable shear plate interferometer. Duffus, R.C. (to Dept. of Energy, Washington, DC). US Patent 4,786,175. 22 Nov 1988. Filed date 26 Sep 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a rotatable shear plate interferometer comprising a tubular member which defines a central axis and is rotatably supported by a bracket means around the central axis, a transparent shear plate obliquely mounted in the tubular member at a fixed angle with respect to the axis, and a viewing screen rotatably attached to the tubular member so as to be able to assume a viewing position such that an interference pattern of a light beam made incident on the shear plate along the central axis can be observed on the veiwing screen placed in the viewing position at any angular position of the tubular member around the central axis, whereby defocus, astigmatism and coma in the incident light beam can be measured in any direction.

20468 The effects of temperature on the response time of thermocouples and resistance thermometers. Carroll, R.M.; Shepard, R.L. (Oak Ridge National Lab., Oak Ridge, TN (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

The response times of sheathed thermocouples and platinum resistance thermometers both bare and in thermowells were measured at temperatures up to 650°C using plunge tests and an in situ loop-current step-response (LCSR) measurement technique. Both methods of measurements agreed over a wide range of sensor sizes and response times, verifying the LCSR method. The response times were temperature dependent. The magnitude and direction of the temperature-dependence of response time varies from sensor to sensor. The response time of the sensor at the operating conditions must be measured when the sensor is at operating temperature.

20469 Performance of Chromel versus Alumel and Nicrosil versus Nisil thermocouple assemblies in vacuum and argon between 1000° and 1200°C. Ludtka, G.M.; Kollie, T.G.; Anderson, R.L.; Christie, W.H. (Development Div., Oak Ridge Y-12 Plant, Oak Ridge, TN (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

Prior work has shown that Nicrosil verus Nisil (Type N) thermocouples exhibit improved thermoelectric stability at elevated temperatures in oxidizing environments than existing nickel base thermocouple alloys. This research has evaluated the performance of Chromel verus Alumel and Nicrosil versus Nisil thermocouple assemblies in vacuum and argon between 1000° and 1200°C. Both sheathed and bare thermocouple wires of various thicknesses were tested. The thermocouples were compared after exposure to the elevated temperatures by measuring thermoelectric drift from initial calibration data and by performing in-place inhomogeneity tests. Under these test conditions, comparable behavior was exhibited by the Type K and Type N thermocouples. However, several conclusions could be made. Thick, bare thermocouples did as well as sheathed thermocouples especially at elevated temperatures where reaction with insulating materials is likely for sheathed thermocouples. Stainless steel sheathed thermocouples tended to exhibit larger maximum errors that Inconel sheathed thermocouples which is a result of contamination by diffusion of sheath component species into the thermoelements. At 1200°C, only the thickest thermocouples (bare or sheathed) survive without shorting or developing significant error for short exposure times. In general, the decalibrations of both types of thermocouples are similar between 1000° and 1200° in both vacuum and argon environments.

20470 Thermoelectric inhomogeneity testing. Reed, R.P. (Sandia National Labs., Albuquerque, NM (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

Thermoelectric inhomogeneity is the anomalous variation of Seebeck, Peltier, and Thomson coefficients along a thermoelement. Where it exists, Seebeck inhomogeneity limits the accuracy to which a thermocouple can be generally calibrated and used. It is an insidious cause of error that is neither detected by nor eliminated by conventional calibration. It often occurs during use. It subtly degrades accuracy, sometimes acceptably, sometimes catastrophically. Well-demonstrated formal test methods have existed for more than 75 years yet adequate homogeneity is more often presumed than it is confirmed by test. The informal methods popularly used to check inhomogeneity are ineffective and have led many users to incorrectly discount the practical significance of inhomogeneity. This paper reviews the basis and limitations of quality specification, analysis, and testing for Seebeck inhomogeneity of thermocouple elements.

20471 **Problems in high temperature thermocouple thermometry.** Kollie, T.G. (Development Div., Oak Ridge Y-12 Plant, Oak Ridge, TN (US)). pp v of Proceedings of the industrial temperature measurement symposium. Kerlin, T.W.; Katz, E.M. Knoxville, TN; University of Tennessee at Knoxville (1985). (CONF-8409109—).

From Industrial temperature measurement symposium; Knoxville, TN, USA (10 Sep 1984).

Thermocouples are the most common thermometers used in science and industry for high temperature measurements. Contrary to common belief, thermocouples are not a panacea for high temperature thermometry, for they too have significant problems associated with their use. Accurate temperature measurements with these instruments can be achieved only when their applications are planned carefully. With the instruments now available, accurate thermocouple thermometry above 1200°C is a herculean task. The error sources in high temperature thermocouple thermometry can be divided into seven categories: Thermal shunting errors, electrical shunting errors, calibration errors, decalibration errors, extension wire errors, reference junction errors, and data acquisition errors. Each error source is described in this paper, specifically: The temperature intervals in which each source is operative; the magnitudes of the sources; difference in sources for various types of thermocouples and environments; and where possible, methods for minimizing, calculating, or measuring the magnitude of the errors. To aid in a more fundamental understanding of error sources, a brief review of the theory of thermocouple thermometry precedes the discussion of the error sources.

4404 Well Logging Instrumentation

20472 **(BHR—40) New model for the long-spacing detector of a gamma-density-tool.** Oelgaard, P.L. (Technical Univ. of Denmark, Lyngby (Denmark). Dept. of Electrophysics). Jun 1987. 26p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE89780063/JAW.

A model for the long-spacing detector of a gamma-density-tool has been developed. It is based on 15-group, diffusion theory and on a point source situated in an infinite medium. The model has been compared with more accurate transport theory calculations and reasonable agreement was observed for the energy flux spectrum, provided the medium contains only limited concentration of elements heavier than Ca, provided the source energy is in the range 0.5 to 2 MeV and provided the source-detector distance multiplied by the attenuation coefficient of the medium at source energy is larger than 4 and less than 10. The model has been used to calculate energy build-up factors and calibration curves for the long-spacing detector, and reasonable agreement was obtained. It has been investigated how the calibration curves depend upon medium composition, source-detector distance, and energy width of detection window. A not too sucessful attempt has also been made to use the model for the determination of the photo-electric factor PEF. While a unique relation between LITH/LS and PEF was observed, it did not agree well with the relation reported in the literature.

20473 **(BHR—42) Pulsed-neutron, capture-gamma borehole logging tool.** Oelgaard, P.L. (Technical Univ. of Denmark, Lyngby (Denmark). Dept. of Electrophysics). Oct 1987. 31p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE89780064/JAW.

The report attempts to give a review of available information on the pulsed-neutron, capture-gamma tool. It starts with a discussion of the general principle of the physics of the tool. Next a review of available tool design data is given, including a special discussion of the source-detector distance. Operational data available on the tool is also considered. These reviews are followed by data on the SIGMAa2200 value of various materials relevant to petroleum technology. Finally the various approaches used to treat the measurements in order to obtain the absorption cross section of the medium are outlined. (author) 20 refs.

20474 **(BHR—43) Neutron porosity tool.** Oelgaard, P.L. (Technical Univ. of Denmark, Lyngby (Denmark). Dept. of Electrophysics). Jan 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE89780065/JAW.

The report contains a review of available information on neutron porosity tools with the emphasis on dual thermal-neutron-detector porosity tools and epithermal-neutron-detector porosity tools. The general principle of such tools is discussed and theoretical models are very briefly reviewed. Available data on tool designs are summarized with special regard to the source-detector distance. Tool operational data, porosity determination and correction of measurements are briefly discussed. (author) 15 refs.

20475 **(BHR—46) Nuclear log interpretation by first principle.** Oelgaard, P.L. (Technical Univ. of Denmark, Lyngby (Denmark). Dept. of Electrophysics). Jul 1988. 10p. (CONF-8809308—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89780066/JAW.

From CEC seminar on "hydrocarbons: source of energy"; Lyon, France (21 Sep 1988).

A weakness connected to the present interpretation of nuclear borehole logs is that the interdependence of the various logs and physical effects of importance for the tools are not always taken into account in a correct way. Therefore a new approach to the interpretation of nuclear borehole logs is considered. It is based on the logs obtained with the natural gamma, the neutron porosity, the gamma density, and the pulsed neutron tools. For each of these tools a model, taking into account the important physical effects, is established. These models are incorporated into a computer programme which from the tool signals calculates, by use of iteration, a consistent set of the corresponding formation properties. In the paper the models developed for the four tools and the interpretation programme are briefly described. An example of the use of the interpretation programme is given and compared with a conventional interpretation.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 21587

4502 Nuclear

REFER ALSO TO CITATION(S) 19674, 19675, 20449

20476 **(ORNL/FEMA—89/1) Electromagnetic pulse survey of the Kentucky State Emergency Operating Center, Frankfort, Kentucky.** Buchanan, M.E.; Cole, O.C.; Jones, R.W.; Marshall, D.J. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 179p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008464/JAW.

The purpose of this report is to develop an engineering design package to protect the Federal Emergency Management Agency (FEMA) National Radio System (FNARS) facilities against the effects of high-altitude electromagnetic pulses (HEMP). This report refers to the Kentucky State Emergency Operating Center (EOC) in Frankfort, Kentucky. It is highly probable that there will be a heavy dependence upon hf radio for long-haul communications following a nuclear attack on the continental United States, should one occur. To maintain the viability of the FEMA hf radio network during such a situation, the FNARS facilities must take measures to protect against the effects of HEMP that are likely to be created in a nuclear confrontation. The equipment under stress has already been designed and built so that little opportunity exists for equipment design changes that could raise the threshold levels at which malfunctions occur. The solution must then be to reduce HEMP-induced stresses on the system by means of tailored retrofit hardening measures using commercial protection devices when available. 30 figs., 2 tabs.

20477 **(SAND—88-0724) Absolute and other tolerances.** Easterling, R.G.; Johnson, M.E.; Bement, T.R.; Nachtsheim, C.J. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1989. Contract AC04-76DP00789. 29p. (LA-UR—88-906). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008187/JAW.

In a production process it is necessary to specify tolerances for characteristics such as dimensions, within which the measured characteristic must fall in order for the part to be acceptable. This tolerance can be based on both functional requirements and an allowance for measurement error. Sandia National Laboratories has provided general guidance for setting tolerances for its parts in Sandia General Requirements Specification 9900000, Sec. 3.3.2, titled Absolute Tolerance Concept. Implementing this guidance, particularly for parts other than Sandia's, has been a source of controversy, so in 1986 a Working Group of DOE statisticians undertook a study of statistical aspects of tolerance specification. This report presents the Group's analysis and findings. Several measures of consumer's risk were defined and then evaluated with respect to computational convenience, information requirement, rationale, and economic considerations. As an aid in setting tolerances, several cost models were considered and the optimum tolerances derived and compared. Because cost considerations have a major effect on the choice of tolerances, it is recommended that design and production personnel attempt to realistically model the cost of nonconformance in jointly arriving at appropriate measurement tolerances. 9 refs., 4 figs., 4 tabs.

4503 Explosion Detection

20478 **(UCID—21611) A concept and plan for experiments to improve ground shock predictions for the EPW [Earth Penetrator Weapons] program.** Thorpe, R.K.; Larson, D.B.; Stout, R.B.; Swift, R.P.; Glenn, H.D. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008645/JAW.

This document summarizes a concept and plan for providing new experimental data to be used in validating ground shock calculations. The effort was supported by the Earth Penetrator Weapons (EPW) Program. Our main objective is to collect information on certain ground motion phenomena that may be observed in larger-scaled field experiments, but at the same time, exercise greater control over experimental conditions. It is recommended that this work be carried out in concert with other experimental programs, such as the Defense Nuclear Agency's high explosive (HE) test program, so that results are correlative or scalable according to explosive yield. Although we expect there to be some differences, the experimental technique we propose offers a cost-effective means of providing repeatable, reliable ground shock data for a wider variety of media and source configurations than can be obtained with field experiments. The cost of the program, however, would depend on the specific number and design of experiments, and is not included in this presentation. 9 refs., 23 figs.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

REFER ALSO TO CITATION(S) 20760

20479 **(IC—88/355) Study of hourly global and diffuse radiation over Southern African locations.** Jain, P.C. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 45p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705990/JAW.

The horizontal monthly average hourly global and diffuse irradiation data of nine South African and three South West African (Namibian) locations have been analyzed using the recently proposed two-parameter β-distribution model. The best-fit values of the monthly parameters α and β and the corresponding errors have been computed and tabulated for all the 12 locations. It is seen that the model fits both the data very well. The model is also found to fit the morning-afternoon asymmetries in the radiation fairly well. Simple equations have been developed separately for the diffuse and the global radiation that can give the values of the two unknown parameters in terms of the day length S/sub O/. This work would be useful to assess the horizontal monthly average hourly global as well as the diffuse irradiation values from the respective daily values in the Southern African region and elsewhere. (author). 7 refs, 4 figs, 54 tabs.

5001 Basic Studies

REFER ALSO TO CITATION(S) 19687, 20199, 20542, 20543

20480 **(INA—ALUR75-76-72) Computer simulation of microclimatic and ground thermal regimes: test results and program description.** Smith, M.W. (Department of Indian and Northern Affairs, Ottawa, Ontario (Canada)). 1977. 78p. (CE—02334). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Work was completed on the development and testing of a computer model which simulates northern Canadian thermal regimes. This report contains a discussion of the final test results together with a complete program description and user manual. The main structural features of the program, called MICRO, are as follows. Inputs of surface weather data and site-specific microclimatic characteristics are used to constrain the surface energy balance. The components of the balance are each specified as functions of the surface temperature, and the equilibrium surface temperature and corresponding values for the energy balance components are also solved. The surface temperature solution is then used as the boundary condition, together with ground thermal properties, to predict the ground temperature distribution via the heat conduction equation. Complex stratigraphy and freeze/thaw energetics are accommodated. The overall energy flow through the natural system is thus simulated. Testing of the model was undertaken to ensure that the model would still perform consistently, if not as accurately, when less comprehensive input data were available. Fieldwork conducted in the Northwest Territories collected weather and cloud cover data, microclimatic measurements which provided data on the energy balance components at two sites as well as on albedo and aerodynamic roughness, and measurements of soil moisture and thermal properties. The results established the accuracy and reliability of the model throughout all aspects of prediction. It has wide application to future or hypothetical events, of a natural or technological nature. 20 refs., 16 figs., 5 tabs.

20481 **(N—89-13851) Determination of spectroscopic properties of atmospheric molecules from high resolution vacuum ultraviolet cross section and wavelength measurements. Semiannual status report No. 8, 1 May-31 October 1988.** Parkinson, W.H.; Yoshino, K.; Freeman, D.E. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Nov 1988. 13p. (NASA-CR—184601; NAS—1.26:184601). NTIS, PC A03/MF A01.

Progress is given on work on: cross section measurements in the transmission window regions of the Schumann-Runge bands of oxygen; the determinations of predissociation linewidths; the theoretical calculation of band oscillator strengths of the Schumann-Runge absorption bands of O-16O-18; the determination of molecular spectroscopic constants; and the combined Herzberg continuum cross sections. The experimental investigations relevant to the cross section measurements, predissociation linewidths, and molecular spectroscopic constants are effected at high resolution with a 6.65 m scanning spectrometer which is, by virtue of its small instrumental width (FWHM = 0.0013 nm), suitable for cross section measurements of molecular bands with discrete rotational structure. Such measurements are needed for accurate calculations of the stratospheric production of atomic oxygen and heavy ozone formed following the photo-predissociation of O-16O-18 by solar radiation penetrating between the absorption lines of O-16(sub 2).

20482 (N—89-14503) **Polar ozone workshop. Abstracts.** Aikin, A.C. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1988. 306p. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—). NTIS, PC A14/MF A01.

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Results of the proceedings of the Polar Ozone Workshop held in Snowmass, CO, on May 9 to 13, 1988 are given. Topics covered include ozone depletion, ozonometry, polar meteorology, polar stratospheric clouds, remote sensing of trace gases, atmospheric chemistry and dynamical simulations.

20483 (N—89-14503, pp 10-12) **Observations of stratospheric temperature changes coincident with the recent Antarctic ozone depletions.** Randel, W.J.; Newman, P.A. (Applied Research Corp., Landover, MD (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

A high degree of correlation between the recent decline in Antarctic total ozone and cooling of the stratosphere during Austral spring has been noted in several recent studies (e.g., Sekiguchi, 1986; Angel, 1986). This study analyzes the observed temperature trends in detail, focusing on the spatial and temporal aspects of the observed cooling. Ozone losses and stratospheric cooling can be correlated for several reasons: (1) ozone losses (from an unspecified cause) will directly reduce temperatures due to decreased solar ultraviolet absorption (Shine, 1986), and/or (2) changes in both ozone and temperature structure due to modification of stratospheric circulation patterns (Mahlman and Fels, 1986). In order to scrutinize various ozone depletion scenarios, detailed information on the observed temperature changes is necessary; the goal is to provide such data. The data used are National Meteorological Center (NMC) Climate Analysis Center (CAC) derived temperatures, covering 1000 to 1 mb (0 to 48 km), for the period 1979 to 1987. Discussions on data origin and quality (assessed by extensive comparisons with radiosonde observations), along with other details of these observations, can be found in Newman and Randel (1988).

20484 (N—89-14503, pp 48-50) **Correlation of N_2O and ozone in the Southern Polar vortex during the airborne Antarctic ozone experiment.** Strahan, S.E.; Loewenstein, M.; Podolske, J.R.; Starr, W.L.; Proffitt, M.H.; Kelly, K.K.; Chan, K.R. (National Oceanic and Atmospheric Administration, Boulder, CO (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

In situ N_20 mixing ratios, measured by an airborne laser spectrometer (ATI AS), have been used along with in situ ozone measurements to determine the correlation of N_2O and ozone in the Antarctic stratosphere during the late austral winter. During the 1987 Airborne Antarctic Ozone Experiment (AAOE), N_2O data were collected by a laser absorption spectrometer on board the ER-2 on five ferry flights between Ames Research Center (37 deg N) and Punta Arenas, Chile (53 deg S), and on twelve flights over Antarctica (53 S to 72 S). Of all the trace gas species measured by instruments on board the ER-2, only one showed a relationship to the N_2O/O_3 correlations in the vortex. With few exceptions, positive N_20/O_3 correlations coincided with total water mixing ratios of greater than 2.9 ppmv, and total water mixing ratios of less than 2.9 ppmv corresponded to negative correlations. The lower water mixing ratios, or dehydrated regions, are colocated with the negative correlations within the vortex, while the wetter regions always occur near the vortex edge.

20485 (N—89-14503, pp 83-84) **Evolution of polar stratospheric clouds during the Antarctic winter.** Ramaswamy, V. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The occurrence of Polar Stratospheric Clouds (PSCs), initially inferred from satellite measurements of solar extinction, have now also been noted by the recent scientific expeditions in the Antarctic. The presence of such clouds in the Antarctic has been postulated to play a significant role in the depletion of ozone during the transition from winter to spring. The mechanisms suggested involve both dynamical and chemical processes which, explicity or implicitly, are associated with the ice particles constituting the PSCs. It is, thus, both timely and necessary to investigate the evolution of these clouds and ascertain the nature and magnitude of their influences on the state of the Antarctic stratosphere. To achieve these objectives, a detailed microphysical model of the processes governing the growth and sublimation of ice particles in the polar stratosphere was developed, based on the investigations of Ramaswamy and Detwiler. The present studies focus on the physical processes that occur at temperatures below those required for the onset of ice deposition from the vapor phase. Once these low temperatures are attained, the deposition of water vapor onto nucleation particles becomes extremely significant. First, the factors governing the magnitude of growth and the growth rate of ice particles at various altitudes are examined. Second, the ice phase mechanisms are examined in the context of a column model with altitudes ranging from 100 to 5 mb pressure levels. The column microphysical model was used to perform simulations of the cloud evolution, using the observed daily temperatures. The effect due to the growth of the particles on the radiation fields are also investigated using a one dimensional radiative transfer model. Specifically, the perturbations in the longwave cooling and that in the shortwave heating for the late winter/early spring time period are analyzed.

20486 (N—89-14503, pp 95-97) **Heterogeneous chemistry related to Antarctic ozone depletion: reaction of $ClONO_2$ and N_2O_5 on ice surfaces.** Tolbert, M. A.; Rossi, M. J.; Golden, D. M. (Sterling, Walter V., Inc., Palo Alto, CA (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Laboratory studies of heterogeneous reactions of possible importance for Antarctic ozone depletion were performed. In particular, the reactions of chlorine nitrate ($ClONO_2$) and dinitrogen pentoxide (N_2O_5) were investigated on ice and HCl/ice surfaces. These reactions occur on the surfaces of polar stratospheric clouds (PSCs) over Antarctica. One reaction transforms the stable chlorine reservoir species ($ClONO_2$ and HCl) into photochemically active chlorine in the form of HOCl and Cl_2. Condensation of HNO_3 in the reactions removes odd nitrogen from the stratosphere, a requirement in nearly all models of Antarctic ozone depletion. Other reactions may also be important for Antarctic ozone depletion. Like the reactions of chlorine nitrate, these reactions deplete odd nitrogen through HNO_3 condensation. In addition, one reaction converts a stable chlorine reservior species (HCl) into photochemically active chlorine ($ClNO_2$). These reactions were studied with a modified version of a Knudsen cell flow reactor.

20487 (N—89-14503, pp 108-112) **Observations of condensation nuclei in the 1987 airborne Antarctic ozone experiment.** Wilson, J.C.; Smith, S.D.; Ferry, G.V.; Loewenstein, M. (Aerosystems, Saint Paul, MN (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The condensation nucleus counter (CNC) flown of the NASA ER-2 in the Airborne Antarctic Ozone Experiment provides a measurement of the number mixing ratio of particles which can be grown by exposure to supersaturated n-butyl alcohol vapor to diameters of a few microns. Such particles are referred to as condensation nuclei (CN). The ER-2 CNC was calibrated with aerosols of known size and concentration and was found to provide an accurate measure of the number concentration of particles larger than about 0.02 micron. Since the number distribution of stratospheric aerosols is usually dominated by particles less than a few tenths of micron in diameter, the upper cutoff of the ER-2 CNC has not been determined experimentally. However, theory suggests that the sampling and counting efficiency should remain near one for parti-

cles as large as 1 micron in diameter. Thus, the CN mixing ratio is usually a good measure of the mixing ratio of submicron particles.

20488 (N—89-14503, pp 151-153) **Observational results of microwave temperature profile measurements from the airborne Antarctic ozone experiment.** Gary, B.L. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The Microwave Temperature Profiler, MTP, is installed on NASA's ER-2 aircraft. MTP measures profiles of air temperature versus altitude. Temperatures are obtained every 13.7 seconds for 15 altitudes in an altitude region that is approximately 5 km thick (at high flight levels). MTP is a passive microwave radiometer, operating at the frequencies 57.3 and 58.8 GHz. Thermal emission from oxygen molecules provides the signal that is converted to air temperature. MTP is unique in that it is the only airborne instrument of its kind. The MTP instrument was used during the Airborne Antarctic Ozone Experiment, AAOE, to enable potential vorticity to be measured along the flight track. Other uses for the MTP data have become apparent. The most intriguing unexpected use is the detection and characterization of mountain waves that were encountered during flights over the Palmer Peninsula. Mountain waves that propagate into the polar vortex may have implications for the formation of the ozone hole. Upward excursions of air parcels lead to a brief cooling. This can begin the process of cloud formation. It is important to determine how much additional formation of polar stratospheric cloud (PSC) material is possible by the passage of air parcels through a mountain wave pattern that endures for long periods. Other mountain wave effects have been suggested, such as a speeding up of the vortex, and a consequent cooling of large air volumes (which in turn might add to PSC production).

20489 (N—89-14503, pp 168) **Small scale structure and mixing at the edge of the Antarctic vortex.** Murphy, D.M.; Tuck, A.F.; Kelly, K.K.; Loewenstein, M.; Podolske, J.R.; Strahan, S.E.; Chan, K.R. (National Oceanic and Atmospheric Administration, Boulder, CO (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Small scale correlations and patterns in the chemical tracers meas-ured from the NASA ER-2 aircraft in the 1987 AAOE campaign can be used to investigate the structure of the edge of the polar vortex and the chemically perturbed region within it. Examples of several types of transport processes can be found in the data. Since ClO and O3 have similar vertical gradients and opposite horizontal gradients near the chemically perturbed region, the correlation between ClO and O3 can be used to study the extent of horizontal transport at the edge of the chemically perturbed region. Horizontal transport dominates the correlation for a latitude band up to 4 degrees on each side of the boundary. This implies a transition zone containing a substantial fraction of the mass of the total polar vortex. Similar horizontal transport can be seen in other tracers as well. It has not been possible to distinguish reversible transport from irreversible mixing. One manifestation of the horizontal transport is that the edge of the chemically perturbed region is often layered rather than a vertical curtain. This can be seen from the frequent reversed vertical gradients of NO2, caused by air with high NO2 overlapping layers with lower mixing ratios. Water and NO2 are positively correlated within the chemically perturbed region. This is the opposite sign to the correlation in the unperturbed stratosphere. The extent of the positive correlation is too great to be attributed solely to horizontal mixing. Instead, it is hypothesized that dehydration and descent are closely connected on a small scale, possibly due to radiative cooling of the clouds that also cause ice to fall to lower altitudes.

20490 (N—89-14503, pp 200) **Zone measurements during wintertime in the Arctic. Comparision with recent measurements at the same places are made. Here the 30 hPa temperatures are shown.** Larsen, S. H. H. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Moon measurements made at Tromso, and at Spitzbergen, 70 and 78 N, back in the fifties have been re-evaluated. One has to take into account that the wedge calibration will change when the focussed image of the moon on the inlet slit is used. A correction was later decided to be used after several experiments in Dobsons Laboratory in Oxford. The absorption coefficients have been changed since the observations were taken and evaluated the first time. The re-evaluated ozone values have been plotted, in one diagram for Spitzbergen, and in one for Tromso. The zonal mean value for ozone is given as a reference. Ozone measurements from the winter season 1985/86 and 1986/87 made at the same places are presented. Here the daylight measurements are incorporated and also TIROS satellite data from single point data retrieval are given. The two winter seasons were very different. In the first we had a late final stratospheric warming, and in the other we had an early final stratospheric warming. This can be seen from the 30 millibar temperatures, provided by Barbara Naujokat, and plotted in the diagrams. Again the zonal mean values of ozone are given as reference.

20491 (N—89-14503, pp 221-223) **Polar vortex dynamics.** McIntyre, M. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Recent work with high resolution, one-layer numerical models of fluid flows resembling those in the real stratosphere has suggested that: (1) the interiors of strong cyclonic vortices like the Antarctic polar vortex may be almost completely isolated laterally from their surroundings - perhaps even completely isolated, under some circumstances; (2) by contrast, material near the edge of such and isolated region can easily be eroded (or mixed one-sidedly) into the surrounding region; and (3) the erosion characteristically produces extremely steep gradients in isentropic distributions of potential vorticity (PV) and of other tracers, possibly down to horizontal length scales of a few kilometers only. Such length scales may occur both at the edge of the main polar vortex and in smaller features outside it, such as thin filamentary structures, produced by the erosion process.

20492 (N—89-14503, pp 231-233) **Radiative aspects of Antarctic ozone hole in 1985.** Akiyoshi, H.; Fujiwara, M.; Uryu, M. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

In order to investigate the radiative heating effects of aerosols during September - October, 1985, at Antarctica, researchers solved the radiative transfer equation using a one-dimensional model, which includes the absorption of solar energy by water vapor, carbon dioxide, ozone and aerosols, the thermal emission and absorption by the above species and in addition, Rayleigh and Mie scattering, and the surface scattering effects. In this calculation, they used data of ozone density, water vapor density and aerosol extinction at 0.385, 0.453, 0.525 and 1.02 mu m in the stratosphere obtained by SAGE II satellite and meteorological data from NOAA. Results show that the Antarctic stratosphere is nearly in radiative equilibrium during that period, if the effects of aerosols are excluded. It is also shown that the heating effects of aerosols are too small to cause effective upward motions, in spite of some ambiguous parameters such as aerosol composition. The parameter dependences of results are also discussed.

20493 (N—89-14503, pp 236-237) **Simulation of the transport of halogen species from the equatorial and mid-latitude stratosphere to the polar stratosphere in a two-dimensional model.** Yung, Y.L.; Shia, R.L.; Allen, M.; Zurek, R.W.; Crisp, D.; Wen, J.S. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The bulk of O sub 3 destruction in the Antarctic stratosphere takes place in the lower stratosphere between 15 and 25 km. Both O sub 3 and the halogen reservoir species have their origins in the higher altitude region (20 to 30 km) in the equatorial and mid-latitude stratosphere. Using the Caltech-JPL two-dimensional residual circulation model, researchers investigate the growth of stratospheric halogen due to the increase of CFCl sub 3 and CF sub 2 Cl sub 2.

20494 (N—89-14503, pp 266) **Modelling the Antarctic lower stratosphere.** Chipperfield, M.P.; Pyle, J.A. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Results form modeling studies of the Antarctic lower stratosphere which have attempted to simulate the large springtime ozone losses and corresponding changes in other trace constituents are given. These studies were carried out in a photochemical box model, a one-dimensional model without transport and in a two-dimensional photochemical-dynamical-radiation model. The photochemical studies have investigated inter alia the sensitivity of ozone to inclusion in the model of heterogeneous chemistry, and to the inclusion of the ClO dimer. When both of these are incorporated in the model, ozone depletions resembling whose found in Halley Bay in 1987 (J.C. Farman, Nature, 329, 1987) can be reproduced. The temporal variations (both diurnal and during the August to October period) of a number of important tracers including HCl, ClONO2, OClO and BrO are discussed. The two-dimensional study concentrated on the difficulty of establishing in the model the dynamical preconditioning of the lower polar stratosphere - low temperatures, low N2O, etc., high ClOx. Calculations are presented to show: (1) the depletion of ozone during the springtime season, (2) the effect of large ozone losses on lower latitudes, and (3) the longer term (multi-year) variations of ozone in Antarctica, assuming realistic increases in the atmospheric halogen burden.

20495 **(PNL—6279-Vol.9) Hanford meteorological station computer codes: Volume 9, The quality assurance computer codes.** Burk, K.W.; Andrews, G.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 171p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008414/JAW.

The Hanford Meteorological Station (HMS) was established in 1944 on the Hanford Site to collect and archive meteorological data and provide weather forecasts and related services for Hanford Site approximately 1/2 mile east of the 200 West Area and is operated by PNL for the US Department of Energy. Meteorological data are collected from various sensors and equipment located on and off the Hanford Site. These data are stored in data bases on the Digital Equipment Corporation (DEC) VAX 11/750 at the HMS (hereafter referred to as the HMS computer). Files from those data bases are routinely transferred to the Emergency Management System (EMS) computer at the Unified Dose Assessment Center (UDAC). To ensure the quality and integrity of the HMS data, a set of Quality Assurance (QA) computer codes has been written. The codes will be routinely used by the HMS system manager or the data base custodian. The QA codes provide detailed output files that will be used in correcting erroneous data. The following sections in this volume describe the implementation and operation of QA computer codes. The appendices contain detailed descriptions, flow charts, and source code listings of each computer code. 2 refs.

20496 **(PNL-SA—16628) Air quality and forest health issues in the 1990s.** Hinds, W.T. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 4p. (CONF-8810301—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006941/JAW.

From Northeastern regional meeting of the Pulp and Paper Manufacturers' National Council for Air and Stream Improvement; Boston, MA, USA (27 Oct 1988).

Interactions of trace gases such as ozone, with forests and with climate stress forests, alter the earth's radiation budget, are increasing in concentration, and can affect the earth's climate. In such cases, three research questions arise regarding air quality: (1) What will change, and by how much, if global air quality induces a climatic change? (2) Where is the climate likely to change? and (3) How might man-made stresses or causative factors be altered to ameliorate or prevent such change? Environmental causes and consequences of human activities are linked together, and linked with natural processes. In this case, the linked concerns are fairly clear: industry, energy generation, and natural processes produce trace gas omissions; these emissions affect both stratospheric and tropospheric ozone concentrations and the earth's radiation budget; reductions in stratospheric ozone allow increases in surface UV-B flux, which is detrimental to both agricultural and forest productivity. Tropospheric ozone increases affect both acidic deposition and forest productivity, and the global effect of any climatic change will affect forest ecosystems and agroecosystems by likely alterations in temperature or rainfall patterns.

20497 **(UCRL—98443-Rev.1) Sensitivity of a two-dimensional chemistry-transport model to changes in parameterizations of radiative processes: Revision 1.** Grant, K.E.; Ellingson, R.G.; Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 6p. (CONF-8808125—1-Rev.1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008024/JAW.

From International radiation symposium; Lille, France (18 Aug 1988).

Radiative processes strongly effect equilibrium trace gas concentrations both directly, through photolysis reactions and indirectly through temperature and transport processes. We have used the LLNL 2-D chemical-radiative-transport model to examine the net sensitivity of equilibrium ozone concentrations to several changes in radiative forcing. Doubling CO_2 resulted in a temperature decrease of 5 K to 8 K in the middle stratosphere along with an 8% to 16% increase in ozone in the same region. Replacing our usual shortwave scattering algorithms with a simpler scattering algorithm led to a 1% to 2% increase in ozone in the lower stratosphere. Finally, correcting our normal CO_2 cooling rates by data derived from line-by-line calculations resulted in several regions of heating and cooling. We observed temperature changes on the order of 1 K to 1.5 K with corresponding changes of 0.5% to 1.5% in O_3. 16 refs., 5 figs.

20498 **Hybrid method in light scattering by an arbitrary particle.** Singham, S.B.; Bohren, C.F. (Los Alamos National Laboratory, Life Sciences Division, Los Alamos, New Mexico 87545). *Applied Optics;* **28**: No. 3, 517-522(1 Feb 1989).

A hybrid method for light scattering by an arbitrary particle using the scattering-order formulation of the coupled dipole method is described. An arbitrary particle is divided into two or more segments, and the field scattered by the particle is obtained from the fields scattered by each segment together with the field due to interactions among segments. An exact or approximate theory is used to calculate the scattered field from each segment, and interactions are included using the scattering-order formulation of the coupled dipole method. Calculations show that for certain particles, this hybrid approach can require fewer computations and give more accurate results than the scattering-order method.

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REFER ALSO TO CITATION(S) 19200, 19216, 19253, 19299, 19367, 19554, 19556, 19711, 20322, 20325, 20555, 20603, 20745, 20751, 20754, 20767

20499 **(ANL/EES-TM—301) A regionalization methodology for sector model input data: Derivation and applications.** Hanson, D.A.; South, D.W.; Oakland, W.H. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008324/JAW.

As indicated, this report describes the general approach used to regionalize energy (quantity) and economic data required by sector models in the TG-B emissions model set. The TG-B model set is a collection of sector emissions models, each of which operates at a regional level. These models project the emissions of the precursors of acid precipitation and related energy use. Each of

these models must be provided with energy or economic input variables at the regional level. To supply these data, a method was devised to generate regional forecasts of the energy and economic variables required by these sector models. The regionalization method, which is based on regional economic theory, is incorporated in the Argonne Regionalization Activity Module (ARAM), which is a component of the model set. ARAM systematically transforms the control values produced by national forecasting models into the regional projections required as input by the sector models. This report describes the regionalization approach incorporated in ARAM and the TG-B emissions model set. 7 refs., 4 figs.

20500 (ANL/EES-TM—306) Industrial Volatile Organic Compounds (VOC) model: Regionalized projections of uncontrolled VOC emissions by source category. South, D.W.; McDonald, J.F.; Bragen, M.J.; Boyd, G.A.; Hanson, D.A.; Rothman, D.S. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 134p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008325/JAW.

In the National Acid Precipitation Assessment Program (NAPAP), Task Group B (TG-B) is responsible for developing and testing models that can be used to project fuel use and air pollutant emissions by energy use sector. As discussed in the Foreword, this work is being carried out in two phases. All activities described in this report have taken place under Phase 1 of the TG-B program. This report addresses one aspect of the system designed to supply energy-economic driver data to the TG-B emissions model set: regionalized projections of uncontrolled industrial VOC emissions by source category. The components of the energy-economic driver module are shown. 6 refs., 4 figs., 5 tabs.

20501 (ANL/EES-TM—330) Industrial Sector Technology Use Model (ISTUM): Regionalized projections of industrial production indexes. South, D.W.; Bragen, M.J.; Macal, C.M.; Hanson, D.A.; Rothman, D.S. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 115p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number TI89008326/JAW.

In the National Acid Precipitation Assessment Program (NAPAP), Task Group B (TG-B) is responsible for developing and testing models that can be used to project fuel use and air pollutant emissions by sector. As discussed in the Foreword, this work is being carried out in two phases. All activities described in this report have taken place under Phase 1 of the TG-B program. This report addresses one aspect of the system designed to supply energy-economic driver data to the TG-B emissions model set: regionalized projections of industrial production indexes by industry group. 15 refs., 4 figs., 8 tabs.

20502 (BFR-T—5-1988) CFC in refrigeration and heat pump systems. Risks and countermeasures. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 26p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757039/JAW.

The following subjects are covered in this report: * The effects of CFC emissions on environment and health, * CFC uses, globally, and particularly in heat pumps, * The possibilities to reduce the CFC emissions from heat pumps and refrigeration systems. (L.E.).

20503 (BNL—42228) An option for the coal industry in dealing with the carbon dioxide global greenhouse effect including estimates for reduced CO_2 emissions technologies. Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). Dec 1988. Contract AC02-76CH00016. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008160/JAW.

A new technical option for the coal industry in dealing with the carbon dioxide greenhouse effect has been devised. The option concerns a "hydrogen economy" based on coal. We have developed a very efficient process called HYDROCARB, which effectively splits coal into carbon and hydrogen. This process produces a clean, pure carbon fuel from coal for application in both mobile and stationary heat engines. We are suggesting that coal refineries be built based on this technology. A co-product of the process is a hydrogen-rich gas. If one is concerned about the greenhouse effect, then either all or part of the carbon can be withheld and either mainly or only the hydrogen is used as fuel. If one desires to attain the ultimate, and eliminate all CO_2 emissions from coal, then all of the carbon can be stored and only the hydrogen used. The option is still open for utilizing the clean carbon, which would be placed in monitored retrievable storage, not unlike the strategic petroleum reserve (SPR). Should the greenhouse effect be found to be a myth in the future, the carbon would be taken out of storage and utilized as a clean fuel, the impurities having been previously removed. This concept can be valuable to the coal industry in response to the arguments of the anti-coal critics. Total capital cost estimates have been made to replace all conventional coal burning power plants in the US with technologies that eliminate emissions of CO_2. These include removal, recovery and disposal of CO_2, nuclear, solar, photovoltaics, biomass, and HYDROCARB. 12 refs., 1 fig. 4 tabs.

20504 (CONF-8810317—2) Design of a tracking system for hazardous waste minimization at US Army installations. Habegger, L.J.; Chiu, Shen-Yann; Martino, L.E.; Snider, M.A.; Wentz, C.A.; Peters, R.W.; Donahue, B. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007380/JAW.

From 16. environmental symposium on environmental compliance and enforcement at DOD installations; New Orleans, LA, USA (18 Oct 1988).

Real-time information on the life history of hazardous materials and hazardous wastes (HM/HW) is essential to waste minimization and efficient environmental and health management at US Army installations. To obtain such information, an HM/HW tracking system was developed to document the chain of custody of HM from points of issue to points of use, and of HW from generation to final disposition. This paper describes the design considerations and the hardware and software requirements of an automated tracking system based on bar codes and designed to monitor the movement of HM/HW in fixed containers at Army installations. Tracking procedures and potential applications of tracking results are also presented. 6 refs.

20505 (CONF-8811173—1) An individual-based forest ecosystems model for projecting forest response to nutrient cycling and climate changes. Post, W.M.; Pastor, J. (Oak Ridge National Lab., TN (USA); Minnesota Univ., Duluth (USA). Natural Resources Research Inst.). 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007212/JAW.

From IUFRO forest simulation systems conference; Berkeley, CA, USA (2 Nov 1988).

Forest ecosystem control over nutrient cycling and response to climate change is explored using a model that simulates the annual establishment, growth, and death of individual trees. The aboveground populations dynamics are extended into the soil environment by tracking changes in carbon and nitrogen content of annual cohorts of litter. In this model, carbon and nitrogen cycles form a positive feedback loop because nitrogen cycling partially limits production and also depends on the amount and chemistry of carbon compounds produced. Temperature and soil water availability are constraints to population dynamics directly and through their feedbacks with soil nitrogen availability and light extinction. Embedding ecosystem feedbacks within a geological and climatological framework, we can expand our view of ecosystems from the stand level to the landscape and regional level. Our model, incorporating these feedbacks and constraints, can predict regional and global ecosystems responses to perturbations such as climate change. Species composition and population dynamics can have a large impact on forest productivity. Simulations of a boreal forest indicate that spruce declines observed for many North American forests can be caused by biotically induced changes in nutrient availability that result from an inverse relationship between litter quality and shade-tolerance of the dominant species. 44 refs., 4 figs.

20506 **(DOE/NBB—0085) A preliminary analysis of US CO_2 emissions reduction potential from energy conservation and the substitution of natural gas for coal in the period to 2010.** Edmonds, J.A.; Ashton, W.B.; Cheng, H.C.; Steinberg, M. (Pacific Northwest Lab., Washington, DC (USA); Brookhaven National Lab., Upton, NY (USA)). Feb 1989. Contract AC06-76RL01830. 61p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008331/JAW.

Carbon dioxide (CO_2) is a product of burning fossil fuels (oil, gas and coal) and fossil fuel burning is the dominant source of global CO_2 emissions amounting to 5.2 petagrams of carbon per year (PgC) in 1985. The control of CO_2 emissions would require control of energy production and use. US emissions were 1.25 PgC in 1985. National Energy Policy Plan (NEPP) projections show total US emissions rising 38% by 2010 to 1.7 PgC. The US Department of Energy (DOE) Carbon Dioxide Research Division (CDRD) has sponsored research at the Pacific Northwest Laboratory (PNL), Brookhaven National Laboratory (BNL), and at the Oak Ridge National Laboratory to do a preliminary assessment of the technical feasibility and consequences of reducing US CO_2 emissions from 1985 levels by 10, 25 or 50 percent by either the year 1995 and 2010. In addition, DOE/CDRD sponsored a daylong roundtable attended by nine experts in the field to discuss this issue. Two methods of CO_2 emissions reduction were considered: energy intensity reductions (conservation), and substitution of natural gas for coal. The study did not address the contribution of other energy supply options or the feasibility of pre- or post-combustion CO_2 removal. Furthermore, the study made no attempt to explore specific policies that might be employed to achieve technically feasible CO_2 emissions reductions. This is not a policy document.

20507 **(EX/IWD—1987) Indicative bibliography, acid precipitation.** Charette, J.-Y. (Environment Canada, Ottawa, Ontario. Inland Waters Directorate). 1987. 231p. (In English and French). (MICROLOG—88-03796). Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This bibliography is intended to avail as much information as possible on acid precipitation to the general public and to the scientific community, and to provide easier accessibility to the document collection available in the Quebec regional office of Canada's Inland Waters and Lands Branch. This edition contains 1421 references, mostly of English publications, from the world literature on acid precipitation. The bibliography is divided into seven main sections: atmospheric environment, aquatic organisms, hydrogeochemistry, terrestrial vegetation, terrestrial fauna, general aspects, and experimental lakes. Most main sections are divided into subsections, and citations are arranged alphabetically by author within each section or subsection.

20508 **(GKSS—88/E/45) Infrared lidar measurement of the diffusion of hydrogen chloride from seaborne waste incineration.** Weitkamp, C. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 12p. (CONF-880870—3). NTIS (US Sales Only), PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007800/JAW.

From 4. international conference on infrared physics; Zurich, Switzerland (22 Aug 1988).

The present paper describes a remote measurement system used to determine the distribution of HCl in the plumes of incineration ships. Used for extensive measurements in three consecutive years in the North Sea incineration area, this system produced enough data to describe the distribution and degradation behavior of HCl in the marine atmosphere. The results provide a quantitative basis to assess the effects and the fate of hydrogen chloride emitted during incineration of organochlorine waste in the North Sea. 10 refs., 1 fig.

20509 **(LRAP—83) Spectroscopic imaging of effluent gases.** Ragnarson, P. (Lund Univ. (Sweden). Dept. of Physics). Feb 1988. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757051/JAW.

This paper investigates the possibilities of imaging effluent gases in atmosphere, using a passive gas-correlation technique in the UV and visible region. The experiments have been focused on SO/sub 2/ but some measurements of NO/sub 2/ have also been carried out.

20510 **(LRAP—84) Laser and optical techniques employed in enviromental monitoring.** Sunesson, A. (Lund Univ. (Sweden). Dept. of Physics). Mar 1988. 67p. (LUTFD2-TFAF—1012-1-66-1988). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757052/JAW.

Monitoring of trace gases in the atmosphere has been performed with differential absorption lidar and differential optical absorption spectroscopy. A new mobile differential absorption lidar system has been constructed it is described in detail and examples of SO/sub 2/ and NO/sub 2/ measurements are given. Studies of the NO/sub 2/ concentration distribution in an urban area during a temperature inversion were performed. Detection of CI/sub 2/ with DIAL was investigated. Using a narrow-bandwidth laser system range-resolved measurements of NO and Hg were investigated. Mapping of NO and Hg plumes was performed. The use of mercury as a tracer gas for geothermal energy exploration was investigated during a field test in Iceland. Contrary to expectations very low mercury concentrations were detected. A high-resolution differential optical absorption system has been constructed and applied in longh-path monitoring of SO/sub 2/ and NO/sub 2/. Detection of atmospheric atomic mercury was investigated. A multipass absorption cell (White cell) has been constructed and used for spectroscopic measurements. Weak oxygen absorption lines in the vicinity of the Hg line were studied both with laser and optical techniques. (With 176 refs.)

20511 (N—89-14503, pp 115-117) **Stratospheric column NO_2 measurements from three Antarctic sites.** Keys, J.G.; Johnston, P.V. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The significance of stratospheric odd-nitrogen compounds in Antarctic ozone depletion studies has prompted an increase in Antarctic activities. Although several species are being studied, work has concentrated on the acquisition of NO_2 data. Ground-based measurements of stratospheric column NO_2 have been made at Arrival Heights, Antarctica, since spring 1982, with some gaps in the data base. Additional data has been acquired since February 1986 at Pole Station and Halley Bay, thus providing a chain of stations across the continent. The technique used is that of absorption spectroscopy in several wavelength regions, although here only those measurements are reported in the 430 to 450 nm region where strongly structured absorption been determined experimentally. However, theory features due to NO_2 are identified in scattered sunlight in the zenith sky. Operation of a moon-tracking system at Arrival Heights has provided some additional data during the polar night. Previous analyses have shown that the NO_2 column observed from the ground is strongly influenced by the season, and by the location of the site with respect to that of the polar vortex. The column amount correlates strongly with stratospheric temperature at about 70 mbar. The present data set further illustrates these features, and demonstrates both the strengths and qualifications apparent in the technique.

20512 (N—89-14503, pp 118) **Ground-based measurements of O_3, NO_2, OClO, and BrO during the 1987 Antarctic ozone depletion event.** Sanders, R.W.; Solomon, S.; Carroll, M.A.; Schmeltekopf, A.L. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Near-ultraviolet absorption spectroscopy in the wavelength range from 330 to 370 nm was used to measure O_3, NO_2, OClO, and BrO at McMurdo Station (78S) during 1987. Visible absorption measurements of O_3, NO_2, and OClO were also obtained using the wavelength range from about 403 to 453 nm. These data are described and compared to observations obtained in 1986. It is shown that comparisons of observations in the two wavelength ranges pro-

vide a sensitive measure of the altitude where the bulk of atmospheric absorption takes place.

20513 (N—89-14503, pp 119) **Near UV atmospheric absorption measurements from the DC-8 aircraft during the 1987 airborne Antarctic ozone experiment.** Wahner, A.; Jakoubek, R.O.; Ravishankara, A.R.; Mount, G.H.; Schmeltekopf, A.L. (Colorado Univ., Boulder (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

During the Airborne Antarctic Ozone Experiment from 28 August to 30 September 1987 near UV zenith scattered sky measurements were made over Antarctic from the NASA DC-8 aircraft using a one third m spectrograph equipped with a diode-array detector. Scattered sky light data in the wavelength range 348 nm to 388 nm was spectrally analyzed for O_3, NO_2, OClO, and BrO column abundances. Slant column abudances of O_3, NO_2, OClO and BrO were determined, using a computer algorithm of nonlinear and linear least square correlation of Antarctic scattered sky spectra to laboratory absorption cross section data. Using measured vertical electrochemical sonde ozone profiles from Palmer, Halley Bay, and the South Pole Stations the slant columns of O_3 were converted into vertical column abundances. The vertical column amounts of NO_2, OClO, and BrO were derived using vertical profiles calculated by a chemical model appropriate for Antarctica. NO_2 vertical column abundances show steep latitudinal decrease with increasing latitude for all 13 flights carried out during the mission. In the regions where NO_2 abudances are low, OClO and BrO were observed. The spatial and temporal vertical column abundances of these species are discussed in the context of the chemistry and dynamics in the antarctic polar vortex during the austral spring.

20514 (N—89-14503, pp 120-123) **Infrared measurements of column amounts of stratospheric constituents in the Antarctic winter, 1987.** Mankin, W.G.; Coffey, M.T. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The discovery of Farman et al. of recent large depletions of ozone in the Antarctic stratosphere in the austral spring has aroused great interest because of its serious potential consequences, as well as its surprising nature. An airborne expedition, including 21 experiments on two aircraft, was mounted for Punta Arenas, Chile, in August and September, 1987, to gather a wide range of data to understand the origins and implications of this phenomenon, known as the ozone hole. As a part of this expedition, a high resolution Fourier transform spectrometer was flown on the DC-8, measuring the column amount of a number of trace gases above the flight altitude. Column results are presented only from the flight of September 21; results from other flights are included in an accompanying paper. The deduced column for ozone HCl, and NO2 deduced from the spectra, plotted as a function of latitude are shown. It should be noted that there are many other factors varying as well as the latitude, but latitude seems to be the variable which most clearly provides a passage across the vortex boundary. It can be seen that south 76 degrees S., the column of ozone, HCl, and NO2, all decreas markedly, The ratio of HCl to Hf, normally about 5:1 in midlatitudes, approaches unity. Clearly the chemistry of chlorine and nitrogen are disturbed in the region of low ozone. While dynamical theories could perhaps explain a reduction of these three gases in the same region, since all are of stratospheric origin, it is difficult to see how any purely dynamical mechanism could produce the observed HCl:HF ratio, since the two gases have similar origins. A close look at other species to be reported as well as the correlation with other measurements, such as ClO supports the conclusion that the ozone depletion is a result of chemical processes which deplete HCl and NOx relative to the midlatitude situation.

20515 (N—89-14503, pp 127-130) **Quantitative observations of the behavior of anomalous low altitude ClO in the Antarctic spring stratosphere, 1987.** Dezafra, R.L.; Jaramillo, M.; Barrett, J.; Emmons, L.; Solomon, P.; Parrish, A. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

During the second National Ozone Expedition ground-based observations at McMurdo Station Antarctica were performed which resulted in a second season's measurement of abnormally large amounts of ClO in the Antarctic spring stratosphere. The original measurements of 1986, in which the presence of this anomalous layer was first discovered, were limited in low altitude recovery of the ClO mixing ratio profile by the restrictions of the spectral bandwidth (256 MHz) which was used to measure the pressure-broadened ClO emission line shape. The 1987 measurements were marked by the use of twice the spectral bandpass employed the previous year, and allow a better characterization of the ClO mixing ratio profile in the critical altitude range 18 to 25 km. In-situ aircraft measurements of ClO made over the Palmer Peninsula during Aug. and Sept. of 1987 by Anderson, et al. effectively determined the important question of the ClO mixing ratio profile at altitudes inaccessible to our technique, below approximately 18 to 18.5 km. These flights did not penetrate further than 75 deg S, however, (vs 78 deg S for McMurdo) and were thus limited to coverage near the outer boundaries of the region of severest ozone depletion over Antarctica in 1987, did not reach an altitude convincingly above that of the peak mixing ratio for ClO, and were not able to make significant observations of the diurnal variation of ClO. The two techniques, and the body of data recovered by each, thus complement one another in producing a full picture of the anomalous ClO layer intimately connected with the region of Antarctic spring ozone depletion. An analysis is presented of the mixing ratio profile from approximately 18 to 45 km, the diurnal behavior, and the secular change in ClO over McMurdo Station during Sept. and early Oct. 1987.

20516 (N—89-14503, pp 131-134) **Daytime ClO over McMurdo in September 1987: Altitude profile retrieval accuracy.** Barrett, J.; Solomon, P.; Jaramillo, M.; Dezafra, R.L.; Parrish, A.; Emmons, L. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

During the 1987 National Ozone Expedition, mm-wave emission line spectra of the 278.6 GHz rotational stratospheric ClO were observed at McMurdo Station, Antarctica. The results confirm the 1986 discovery of a lower stratospheric layer with approximately 100 times the normal amount of ClO; the 1987 observations, made with a spectrometer bandwidth twice that used in 1986, make possible a more accurate retrieval of the altitude profile of the low altitude component of stratospheric ClO from the pressure broadened line shape, down to approximately 16 km. The accuracy of the altitude profile retrievals is discussed, using the daytime (09:30 to 19:30, local time) data from 20 to 24 September, 1987 as an example. The signal strength averaged over this daytime period is approx. 85 percent of the midday peak value. The rate of ozone depletion implied by the observed ClO densities is also discussed.

20517 (N—89-14503, pp 136-137) **Temporal and spatial distribution of stratospheric trace gases over Antarctica in August and September, 1987.** Coffey, M.T.; Mankin, W.G. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

There have been a large number of suggestions made concerning the origin of the Antarctic 'ozone hole' since its discovery; these changes include stratospheric chemistry, or changes in the solar input, or combinations of these effects. Supporting or refuting these theories requires a wide variety of data for comparison with the predictions. In Aug. and Sept., 1987, a field observation expedition was made over Antarctica from a base in Punta Arenas, Chile. Two aircraft, an ER-2 with in-situ instruments flew at altitudes up

to 18 km measuring ozone, water, ClO, BrO, NO sub x, particles, and meteorological parameters in the ozone layer. A DC-8 flew at altitudes of 10 to 12 km, below the ozone layer, using remote sensing instruments for measuring composition and aerosol content of the ozone layer, as well as in-situ instruments for measuring composition at aircraft altitudes. The obsevation of a number of chemical species and their correlation with each other and with meteorological parameters gives a useful set of data for comparison with various theories.

20518 (N—89-14503, pp 139) **Observations of diurnal variations of BrO and OClO at McMurdo Station, Antarctica (78S).** Solomon, S.; Sanders, R.W.; Carroll, M.A.; Schmeltekopf, A.L. (Colorado Univ., Boulder (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Observations of the diurnal variations of OClO and BrO during austral spring, 1987 using long-path visible and near-ultraviolet absorption spectroscopy are presented and compared to simplified model calculations. It is shown that care must be taken to compare model calculations and measurements along the line of sight of the instrument. Evening twilight observations of OClO are shown to be broadly consistent with current photochemical schemes, assuming ClO and BrO levels near 50 mb of about 0.5 ppbv and 7 pptv, respectively, throughout the observing period from late Aug. to mid-Oct. Nighttime observations of OClO obtained using the moon as a light source display evidence for growth through the night in late-Aug., but not in late-Sept. Further, the observed morning twilight OClO abundances are in agreement with model calculations in late August, but generally fall below in late September and October. Observations of BrO in mid-Sept. systematically show far greater evening twilight than morning twilight abundances.

20519 (N—89-14503, pp 147-148) **Measurements of NO and total reactive odd-nitrogen, NOy, in the Antarctic stratosphere.** Fahey, D.W.; Murphy, D.M.; Eubank, C.S.; Ferry, G.V.; Chan, K.R.; Ko, M.K.W. (Atmospheric and Environmental Research, Inc., Cambridge, MA (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Measurements of NO and total reactive N, NOy, were made as part of the Airborne Antarctic Ozone Experiment conducted in Punta Arenas, Chile during Aug. and Sept. 1987. The total reactive N reservoir includes the species NO, NO2, NO3, N2 O5, HNO3, and ClONO2. The instrument was located on board the NASA ER2 aircraft which conducted 12 flights over the Antarctic continent reaching altitudes of 18 km at 72 deg S latitude. The NOy technique utilized the conversion of component NOy species to NO on a gold catalyst and the subsequent detection of NO by the chemiluminescence reaction of NO with ozone. Since the inlet sample line is heated and the catalyst operates at 300 C, NOy incorporated in aerosols evaporates and is converted to NO. NO was measured on two separate flights by removing the catalyst from the sample inlet line.

20520 (N—89-14503, pp 150) **Southern Hemispheric nitrous oxide measurements obtained during 1987 airborne Antarctic ozone experiment.** Podolske, J.R.; Loewenstein, M.; Strahan, S.E.; Chan, K.R. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

The chemical lifetime of N2O is about 150 years, which makes it an excellent dynamical tracer of air motion on the time scale of the ozone depletion event. For these reasons it was chosen to help test whether dynamical theories of ozone loss over Antarctica were plausible, particularly the theory that upwelling ozone-poor air from the troposphere was replacing ozone-rich stratospheric air. The N2O measurements were made with the Airborne Tunable Laser Absorption Spectrometer (ATLAS) aboard the NASA ER-2 aircraft. The detection technique involves measuring the differential absorption of the IR laser radiation as it is rapidly scanned over an N2O absorption feature. For the AAOE mission, the instrument was capable of making measurements with a 1 ppb sensitivity, 1 second response time, over an altitude range of 10 to 20 kilometers. The AAOE mission consisted of a series of 12 flights from Punta Arenas (53S) into the polar vortex (approximately 72S) at which time a vertical profile from 65 to 45 km and back was performed. Comparison of the observed profiles inside the vortex with N2O profiles obtained by balloon flights during the austral summer showed that an overall subsidence had occurred during the winter of about 5 to 6 km. Also, over the course of the mission (mid-August to late September), no trend in the N2O vertical profile, either upward or downward, was discernible, eliminating the possibility that upwelling was the cause of the observed ozone decrease.

20521 (N—89-14503, pp 187) **Observations of stratospheric source gas profiles during the Arctic winter.** Schmidt, U.; Bauer, R.; Kulessa, G.; Klein, E.; Schubert, B. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

An international campaign was performed at ESRANGE rocket base, near Kiruna, Sweden (68 N) from January 4 to February 15 in order to investigate the chemistry of ozone in the Polar Stratosphere (CHEOPS). Within the framework of this campaign two sets of large stratospheric air samples were collected by means of a balloon borne cryogenic air sampler. The two balloons were launched on February 1, and February 10, 1988. At present the samples are analyzed in our laboratory for their contents of several long lived trace gases such as CH_4, N_2O, H_2, CO_2, CO and the major halocarbons CH_3Cl, $CFCl_3$, CF_2Cl_2, CCl_4, CH_3CCl_3, and $C_2F_3Cl_3$. The vertical profiles derived from these samples will be presented and compared with previous observations made in February 1987. The data will be discussed in view of the dynamical evolution of the Arctic polar vortex during this winter.

20522 (N—89-14503, pp 189-190) **In situ observations of ClO in the wintertime Northern Hemisphere: ER-2 aircraft results from 21 N to 61 N latitude.** Brune, W.H.; Toohey, D.W.; Anderson, J.G.; Danielsen, E.F.; Starr, W.L. (Harvard Univ., Cambridge, MA (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Measurements of lower stratospheric ClO taken during a NASA ER-2 flight between Moffett Field, CA (37 N, 122 W) and Great Slave Lake, Canada (61 N, 116 W) on 13 February 1988 are reported. Northbound, the aircraft was flown at about 20 km altitude from 39 N to 56 N, at 18 km from there to 58 N, in a descent to 15 km at 60 N, and in a rise and turn at the northernmost point. The southbound leg was flown in a gradual climb from 20 km to 21.5 km. On this day, the central position of the Arctic polar vortex, as determined by an NMC analysis of heights and temperatures at the 50 mb and 70 mb levels, was approximately 79 N, 100 W. Because the vortex was located on the North American side of the pole, the aircraft was able to reach a point slightly inside the maximum horizontal wind region where wind speeds were 80 to 90 knots. The general pattern for the observed ClO is that it increased with both latitude and altitude, and attained a maximum of about 55 pptv at 61 N latitude and 20.5 km altitude. This value is about 20 times smaller than the maxima observed over Antarctica, but is comparable to those seen just outside the chemical containment vessel located inside the Antarctic Polar vortex. On the other hand, in a comparison with northern midlatitude data taken on this and three other February flights, ClO mixing ratios observed north of 55 N latitude are 2 to 5 times larger at all flight altitudes (15 to 20 km). Possible reasons are discussed for this enhancement over midlatitude and the evidence is considered for whether or not the instruments sampled Arctic polar vortex air. A second feature of the data is the strong positive correlation between ClO and O3 during the entire flight.

20523 (N—89-14503, pp 191-192) **Visible and near-ultraviolet spectroscopy at Thule AFB (76.5 N) from January 28 - February 15, 1988.** Mount, G.H.; Sanders, R.W.; Jakoubek, R.O.; Schmeltekopf, A.L.; Solomon, S. (Colorado Univ., Boulder (USA)). May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Near-ultraviolet and visible spectrographs identical to those employed at McMurdo Station, Antarctica (77.8 S) during the austral spring seasons of 1986 and 1987 were used to study the stratosphere above Thule, Greenland (76.5 N) during early spring, 1988. Observations were carried out both at night using the direct moon as a light source, and during the day. Excellent meteorological conditions prevailed in the troposphere and stratosphere at Thule. Surface weather was extremely clear over most of the period, facilitating measurements of the direct light from the moon. The lower stratospheric arctic polar vortex was located very near Thule throughout the observing period, and temperature at the 30 mbar level were typically below -80 C above Thule, according to the National Meteorological Center daily analyses. Total column ozone abundances were about 350 to 400 Dobson units, and did not suggest a clear temporal trend over the observing period. Stratospheric nitrogen dioxide measurements were complicated by the presence of a large component of tropospheric pollution on many occasions. Stratospheric nitrogen dioxide could be identified on most days using the absorption in the scattered light from the zenith sky, which greatly enhances the stratospheric airmass while suppressing the tropospheric contribution. These measurements suggest that the total vertical column abundance of nitrogen dioxide present over Thule in February was extremely low, sometimes as low as 3 x 10 to the 14th per sq cm. The abundance of nitrogen dioxide increased systemically from about 3 x 10 to the 14th in late January to 1.0 x 10 to the 15th per sq cm in mid-February, perhaps because of photolysis of N2O5 in the upper part of the stratosphere, near 25 to 35 km.

20524 (N—89-14503, pp 193-195) **Ozone and nitrogen dioxide ground based monitoring by zenith sky visible spectrometry in Arctic and Antarctic.** Pommereau, J.P.; Goutail, F. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Unattended diode array spectrometers have been designed for ground based stratospheric trace species monitoring by zenith sky visible spectrometry. Measurements are performed with a 1.0 nm resolution between 290 nm and 590 nm in order to allow simultaneous evaluations of column densities of ozone, nitrogen dioxide. Field tests have shown that the species can be monitored with a precision of + or - 2 Dobson for the first and + or - 2.10 to the 15th mol/sq cm for the second, although the absolute accuracy of the method is limited by the error of the estimation of the atmospheric optical path of the scattered light. Two identical instruments were set up in January 1988, one in Antarctica at Dumont d'Urville (66 S, 140 E) to be operated all year and another one in the Arctic at ESRANGE at Kiruna (68 N; 22 E) which will operate to the final warming of spring 1988. The data are processed in real time at both stations. O3 and NO2 columns are transmitted together with surface and stratospheric temperature and winds. They are also recorded for further treatment and search for OClO and BrO. Only one month of data from Antarctica is available at the moment. Obtained during polar summer, they cannot show more than stable columns of O3 and NO2 and for the last species, the buildup of its diurnal variation.

20525 (N—89-14503, pp 206-207) **In situ observations of BrO over Antarctica: ER-2 aircraft results from 54 S to 72 S latitude.** Brune, W.H.; Anderson, J.G. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Bromine monoxide was observed in situ at approximately 18 km altitude during nine flights of the NASA ER-2 aircraft from Punta Arenas, Chile (54 altitude) to 72 S latitude over the Palmer Peninsula, Antarctica. The first flight for the BrO detection system was on 28 August. Here, the results from the flights over Antarctica and from the ferry flights from Punta Arenas to Moffett Field, CA (37 N latitude are reported. A key question concerning BrO, then, is how it is distributed with respect to the chemical containment vessel defined by elevated ClO mixing ratios. This question is answered with greatest statistical significance if the data are averaged into five regions: outside the vessel, aircraft heading south; inside the vessel on the same potential temperature surface; in the dive region; inside the vessel on a given potential temperature surface, aircraft heading north; and outside the vessel on the same surface. The result is that the BrO distribution inside the chemical containment vessel was different from that found outside. Inside, the BrO mixing ratio was (5.0 plus or minus 1.1) pptv between the 400 K and 460 K potential temperature surfaces, decreasing only slightly with potential temperature, and was less than 3.6 pptv below the 4 00 K surface. The abundance of BrO inside the chemical containment vessel showed no discernible temporal trend during the course of the nine flights. Outside the vessel, the BrO mixing ratio was (4.7 plus or minus 1.3) pptv near the 450 K surface, but decreased to (2.8 plus or minus 1.0) pptv near the 420 K surface.

20526 (N—89-14503, pp 272) **Stratospheric feedback from continued increases in tropospheric methane.** Rowland, F.S.; Blake, D.R. May 1988. NTIS, PC A14/MF A01. (NASA-CP—10014; REPT—88B0234; NAS—1.55:10014; CONF-8805271—).

From Polar ozone workshop; Snowmass, CO, USA (9 May 1988).

Tropospheric concentrations of methane have increased steadily over the past ten years at an average rate of 16.5 ppbv per year, to a value in January 1988 of 1.69 ppmv. Measurements of CH sub 4 concentrations in air bubbles trapped in ice cores have shown concentrations of about 0.7 ppmv 200 years ago, with little further change for thousands of years before that. Interpolation earlier into this century suggests a concentration of about 1.1 to 1.2 ppmv in the 1940's. The only important pathway believed to be important for transfer of air from the troposphere to the stratosphere in through the tropical tropopause which is cold enough to reduce the mixing ratio of H sub 2 O in that air to about 3 ppmv. The only other major pathway for the delivery of H to the stratosphere is through the simultaneous injection of gaseous CH sub 4 in the same rising air. The formation of clouds in the stratosphere is dependent upon very low temperatures, and generally upon the amount of water vapor available. The possibility of a positive feedback exists, especially in well-oxidized methane air, that clouds are easier to form than earlier. This could mean enhancement of PSCs in both Antarctic and Arctic locations. Additional H sub 2 O in the stratosphere can also add to some of the greenhouse calculations.

20527 **(NILU-OR—19/88) Atmospheric lead emmissions in Europe in 1985.** Pacyna, J.M. (Norsk Inst. for Luftforskning, Lillestroem (Norway)). Mar 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757058/JAW.

Atmospheric emissions of lead (Pb) from various sources in the European countries are presented for 1982. Emission estimates are based on emission factors and statistical information on the consumption of fossil fuels and the production of industrial goods. A total emission of ca. 90 000 t Pb was estimated, with 76% contribution from combustion and marketing of gasoline. Primary non-ferrous metal production in smelters accounted for 14,5%, iron and steel manufacturing 4%, fossil fuel combustion in electric power plants, and in industrial, residential and commercial boilers 3%, and the rest was ascribed to emissions from cement production, fuelwood combustion and waste-related sources. One third of the European emissions of atmospheric Pb were released from sources in the Soviet Union, almost the same amount was emitted from the three West European countries: United Kingdom, France and Italy, and the last third of the Pb releases in Europe are accounted for other countries. The spatial distribution of Pb emissions is shown in the EMEP grid of 150 km * 150 km. 20 ref., 1 drawing, 9 tables.

20528 **(ORNL/M—697) Biomedical and environmental sciences programs at the Oak Ridge National Laboratory.** Richmond, C.R.; Johnson, C.A. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 110p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007925/JAW.

This overview is designed to provide programmatic and other information about the Oak Ridge National Laboratory (ORNL) Biomedical and Environmental Sciences Program. The mission is to conduct quality research and development for our sponsors, using our local resources and collaborative groups in Oak Ridge and elsewhere. The goals are excellence in both basic and applied research, appropriate educational training activities, and technology transfer.

20529 **(ORNL/TM—10758) Air pollution effects field research facility: Ozone flow control and monitoring system.** McEvers, J.A.; Bowers, T.L.; Edwards, N. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007922/JAW.

The Ozone Flow Control and Monitoring System was developed in 1986 for the controlled exposure of diverse plant species to various concentrations of ozone gas. Design, operation, and performance are described for the automated system for generation, distribution, sampling, analysis, and control of ozone gas for plant exposure. The system has proved to be reliable, easy to maintain, and flexible in adapting to exposure programs. System software is reliable, and the user interface (CRT keyboard) is easy to use, providing quick-glance viewing of overall exposure conditions. The capability to expose plants to ozone concentrations in multiples of the ambient ozone level has been added, and software improvements in the areas of system response and user input are planned. 19 figs., 3 tabs.

20530 **(PNL-SA—16315) A simple model for wind field estimation in complex terrain.** Skyllingstad, E.D.; Andrews, G.L. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 15p. (CONF-890133—6). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007240/JAW.

From 6. joint conference on applications of air pollution meteorology; Anaheim, CA, USA (29 Jan 1989).

In this paper, a prognostic mixed-layer model is presented that provides a time-dependent wind field for use in situations where data are sparse or limited to only one observing site. Such a model could provide improved estimates of atmospheric transport for dispersion modeling. The model is based on a form of the Navier-Stokes equations integrated over the depth of the atmospheric boundary layer. This type of model has been used in many applications including the simulation of terrain drag, development of a climatological wind field, and modeling drainage winds. To provide a more realistic approximation of boundary layer growth, a one-dimensional boundary-layer model is used for obtaining entrainment rates at the top of the mixed layer.

20531 **(SNV—3410) CFCs/Freons. Proposals to protect the ozone layer.** (Statens Natuurvaardsverk, Solna (Sweden)). Dec 1987. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757065/JAW.

To secure a 25% reduction in use of the CFCs 11, 12, 113 and 114 over the next few years, the Environmental Protection Board sees a need for a combination of economic mechanisms, certain regulatory measures, information, and support for alternative technologies. The Board therefore recommends that the following measures be introduced. 1. A special levy of around 50 kr/kg should be introduced on imports of CFCs 11, 12, 113, 114 and 115. 2. In areas of use in which alternatives to products involving fully halogenated CFCs can be introduced, a levy should be supplemented with prohibitions from a given date, set sufficiently far ahead to be able to influence product development and company planning. 3. To minimize deliberate and unintentional emissions from refrigeration and heating equipment, regulations should be introduced governing the design, operation and maintenance of such equipment, under the Act on Chemical Products. 4. A provision should be included in the Government Procurement Ordinance to the effect that environmental effects are one of the factors central government agencies must take into account. 5. Experiments on the incineration of insulating material from refrigerators etc. carried out to date should be followed up. 6. It should be made compulsory to notify the environmental protection and public health committee of the local authority when CFC-113 is used for cleaning, degreasing, drying etc. 7. The existing ban on the use of CFCs as aerosol propellants should be extended to include spray cans used to spray CFCs only and the use of CFCs as propellants in food products. 8. The Environmental Protection Board assumes, finally, that firms manufacturing flexible and rigid plastics foams will be required by the permits issued to them under the Environment Protection Act to install CFC recovery equipment.

20532 **(SNV—3475) Air- and precipitation chemistry station network within the PMK. Progress report 1987.** Granat, L. (Stockholm Univ. (Sweden). Dept. of Meteorology). (National Swedish Environmental Protection Board, Solna). Sep 1988. 58p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757067/JAW.

This report describes the concentration distribution of certain substances in the precipitation over Sweden. Two concentration patterns are shown, one for substances of anthropogenic origin (excess sulfate, nitrates, ammonium and hydrogen ions) and one for substances emanating from sea salt (sodium, chloride and to a certain degree, magnesium). The concentration of anthropogenic substances decrease from south to north in southern Sweden and from west to east in the northern part of the country. The values are always higher along the coastline. The concentration of sea salt is highest on the west coast with a rapid decrease when moving inland. The pattern of wet deposition is completely different. The highest deposition of the main components is found in the central part of southern Sweden, where the precipitation values are high. The lowest values of anthropogenic components in precipitation is found along the mountain ridge in northern and western Sweden, though the precipitation there is relatively intense. Sweden, as a whole, is more or less affected by anthropogenic pollution which means that a natural background level is difficult to define. (U.W.).

20533 **(SNV—3476) PMK program for the measurement of trace metals in wet deposition. Progress report 1987.** Ross, H.; Bengtsson, I. (Stockholm Univ. (Sweden). Dept. of Meteorology). (National Swedish Environmental Protection Board, Solna). Sep 1988. 76p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757068/JAW.

The purpose of this program is to determine the wet deposition of Cd, Cu, Fe, Mn, Pb, Zn, Cr, Ni and V in Sweden, and to correlate wet deposition fluxes of these metals to their concentration in mosses. Atmospheric precipitation is collected on a monthly basis in open funnel and bottle collectors at 7 sites. At each station there are three collectors. Collectors are 1 m from the ground in open fields, at least 10 m from the nearest tree. The maximum distance between collectors does not exceed 40 m. Sampling locations are at least 500 m from the nearest road and 200 m from the nearest building. Highest metal concentrations are found in southern Sweden and decrease northward. Concentrations at station BR, in north-central Sweden, are the lowest; approximately 2-4 times lower than levels in the south. For Cd, Fe, Mn and Zn concentrations have remained essentially the same between 1984 and 1987. Cu concentrations during 1987 increased dramatically. We do not know the reason for this and are investigating the possibility that samples were contaminated. The concentration of Pb in precipitation has continued to decline. In southern Sweden Pb concentrations and wet deposition are at least a factor of 3 lower in 1987 than in 1984. We believe that this is due to reduction of Pb use in gasoline. (authors).

20534 **(TVA/RD/SM—88/1) Fifth annual Gatlinburg acid rain conference: Proceedings.** Olem, H. (ed.). (Tennessee Valley Authority, Chattanooga (USA)). Oct 1988. 68p. (CONF-8810142—Absts.). NTIS, PC A04/MF A01 - OSTI. Order Number DE89006438/JAW.

From 5. annual Gatlinburg acid rain conference; Gatlinburg, TN, USA (31 Oct 1988).

This document contains abstract of 24 papers presented at the conference. Topics included NAPAP assessment plans, precipitation chemistry sampling, dry deposition of sulfur and nitrogen, aquatic deposition, stream chemistry, mitigation methods, biological effects and various site characterization reports. (TEM)

20535 (VTT-TUTK—568) Influence of acidifying air impurities on plasters. Silvennoinen, K.; Pyy, H. (9698851FI;). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Nov 1988. 63p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757115/JAW.

Building materials, e.g. marble, limestone and plasters, especially lime plasters, have been detected to weather in such areas, where concentrations of acidifying air impurities are high. Even buildings, which have been in good condition for hundreds of years, have started to weather faster and faster. According to many research reports, the weathering is due to sulfur oxides, which affect both in gas and liquid phase. The effects of sulfur compounds on the weathering of marble, limestone and plasters were first examined in the literature study. Both information about concentrations of sulfur oxides in the atmosphere and series of plaster samples from Helsinki, the Ahvenanmaa archipelago, Tampere, Mikkeli and Oulu were procured for experimental investigations. The sulfur content of samples was analyzed by an automatic carbon-sulfur-analyzer and the weathering state by thin section analyses. Especially some samples from Helsinki had high sulfur content. According to the thin section analyses there was a layer of gypsum on the surfaces of plasters. However, on the surfaces wetted by driving rain, there was no gypsum because of dissolving. The results have a good correlation with the weatherings mechanisms presented in the literature. The old lime plaster samples collected from the Ahvenanmaa archipelago had very low sulfur content and according to the thin section analyses there were no gypsum layers. According to the sulfur content and thin section analyses the formation of gypsum is mainly caused by local emissions. The weathering rate could not be studied due to the limited amount of field samples. This would presuppose long-term field tests started immediately after plastering. The role of nitrogen compounds on weathering was not studied.

20536 (WSL-LR—653-(AP)) Report on the assessment of the comparability of the United Kingdom's net acidity method for monitoring sulphur dioxide against the UV-fluorescence method. McInnes, G. (Warren Spring Lab., Stevenage (UK)). Feb 1988. 51p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

An assessment of the results obtained between November 1985 and October 1987, analysed in accordance with the tests proposed by the Institute for Hygiene and Epidemiology (IHE), Brussels is presented. In general the net acidity method overestimated SO/sub 2/ concentrations, although at three of the seven sampling locations peak daily average SO/sub 2/ concentrations were lower from the net acidity sampler than from the UVF analysers.

20537 Test ventilation with smoke, bubbles, and balloons. Pickering, P.L.; Cucchiara, A.L.; Gonzales, M.; McAtee, J.L. (Chemistry Health Protection, Los Alamos National Lab., Los Alamos, NM (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 898-907(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-01-3.

The behavior of smoke, bubbles, and helium-filled balloons was videotaped to demonstrate the mixing of air in the plutonium chemistry laboratories a plutonium facility. The air-distribution patterns, as indicated by each method, were compared. Helium-filled balloons proved more useful than bubbles or smoke in the visualization of airflow patterns. The replay of various segments of the videotape proved useful in evaluating the different techniques and in identifying airflow trends responsible for air mixing.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 19356, 19633, 19652, 19722, 20560, 20590, 21319

20538 (CTA-IEAV-NT—01/86) Review of the facile (FN) method in particle transport theory. Garcia, R.D.M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Feb 1986. 53p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705414/JAW.

The facile F/sub N/ method for solving particle transport problems is reviewed. The fundamentals of the method are summarized, recent developments are discussed and several applications of the method are described in detail.

20539 (IC—88/294) Analysis of the wind data and estimation of the resultant air concentration rates. Hu, Shze Jer; Katagiri, Hiroshi; Kobayashi, Hideo. (International Centre for Theoretical Physics, Trieste (Italy); Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 27p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705980/JAW.

Statistical analyses and comparisons of the meteorological wind data obtained by the propeller and supersonic anemometers for the year of 1987 in the Japan Atomic Energy Research Institute, Tokai, were performed. For wind speeds less than 1 m/s, the propeller readings are generally 0.5 m/s less than those of the supersonic readings. The resultant average air concentration and ground level γ exposure rates due to the radioactive releases for the normal operation of a nuclear plant are over-estimated when calculated using the propeller wind data. As supersonic anemometer can give accurate wind speed to as low as 0.01 m/s, it should be used to measure the low wind speed. The difference in the average air concentrations and γ exposure rates calculated using the two different sets of wind data, is due to the influence of low wind speeds at calm. If the number at calm is large, actual low wind speeds and wind directions should be used in the statistical analysis of atmospheric dispersion to give a more accurate and realistic estimation of the air concentrations and γ exposure rates due to the normal operation of a nuclear plant. (author). 4 refs, 3 figs, 9 tabs.

20540 (IFIN-FT—325-1988) Protracted releases: inferring source terms and predicting dispersal. Vamanu, D.V. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Feb 1988. 48p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706042/JAW.

Analytical solutions are given to the transport-diffusion equation for archetype, atmospheric protracted releases featuring fronts of initiation, culminations, and tails of extinction. The interplay of the fitting parameters ensures that the model accommodates a wide typology of events, nearing in the extremes the instantaneous puff of the Lagrangian models, and the continuous stack emission of the Gaussian models, respectively.

20541 (INIS-BR—1411, pp 139-148) Atmospheric dispersion experiments and extended meteorological measurements around an isolated hill. Heinemann, K.; Moellmann-Coers, M.; Zeuner, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

About 15 years ago dispersion parameters for the Gaussian plume model were determined over a falt countryside in the northeast of Juelich. By the activities of coal mining the artificial hill "Sophienhoehe" has arisen in this area. In order to study its influence on the atmospheric dispersion extended metereological measurements of the wind field and dispersion experiment are carried out in this region. The main objective of these investigations is the compilation of a data base for the validation of different meteoro-

logical dispersion models for complex terrain. The methods of the meteorological measurements and dispersion experiments are described and some first results are presented.

20542 **(INIS-BR—1433) Use of microcomputers in the environmental analysis of research nuclear reactors.** Molnary, L. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). (Sociedade Brasileira de Meteorologia, Rio de Janeiro, RJ (Brazil)). 1988. 5p. (In Portuguese). (CONF-8811170—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705756/JAW.

From 5. Brazilian congress on meteorology; Rio de Janeiro, Brazil (7 Nov 1988).

An automatic meteorological monitoring system developed by Department of Reactor Technology of IPEN/CNEN-SP, is described. The system integrates an environmental analysis program of research reactors. The basic characteristic of this system is the utilization of personal computers to control all meteorological data aquisition in a several levels instrumented tower.

20543 **(INIS-mf—11904) NIR annual report 1987.** (Niedersaechsisches Inst. fuer Radiooekologie (Germany, F.R.)). 1988. 160p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757134/JAW.

The fourth annual report of the Niedersaechsisches Institut fuer Radiooekologie (NIR) is intended to describe the scientific work of the institute and its members in 1987. The central part of this publication are the fourteen reports on scientific activities, to be divided into four large categories: - Behaviour of tritium in the atmosphere and the soil - on this, important new knowledge was gained in 1987 in an experiment in Canada on the release of this substance; - Investigations in the radioecology of iodine 129, the dependence of its mobility in the soil on humus substances and microorganisms, and its enrichment in the human thyroid gland; - Establishment of transfer factors in the food chain for fission products like cesium 137, cesium 134 and strontium 90 - this being a field where exact knowledge has regained great importance after the accident at Chernobyl; - Aerosol-physical investigations: on the one hand, to obtain data on the propagation of nutrient aerosols and aerosols carrying harmful substances in areas with vegetation, and on the other hand to measure 'snow-out' and 'fog-out' coefficients. To this are added a number of papers on the stability of the decontamination substance for cesium 137 - ammonium-iron-hexacyanoferrate (AIHCF) - in the soil, on the translocation of cesium in apple-trees, and on the improvement of the analytics for uranium and plutonium in environmental specimens.

20544 (KFK—4444, pp 43-67) **Tritium in the food chain.** Koenig, L.A. Sep 1988. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

Tritium is a hydrogen isotope taking part in the global hydrogen cycle as well as in all metabolic processes. The resultant problems with respect to the food chain are summarized briefly with emphasis on 'organically bound tritium'. However, only a small number of the numerous publications on this topic can be taken into consideration. Publications describing experiments under defined conditions are reported, thus allowing a semiempirical interpretation to be made. Tritium activity measurements of food grown in the vicinity of the Karlsruhe Nuclear Research Center have been carried out. A list of the results is given. A dose assessment is performed under simplifying assumptions. Even when the organically bound tritium is taken into account, a radiation exposure of less than 1% of that of K-40 is obtained under these conditions. To avoid misinterpretation, the specific activity (Bq H-3/g H) of water-bound and organically bound tritium has to be considered separately.

20545 **An overview of airborne radioactive emissions at a national laboratory.** Guevara, F.A.; Dvorak, R.F. (Radiation Protection Group (US); Accelerator Health Protection Group, Los Alamos National Lab.). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **93**: No. 2, 1532-1546(Jun 1987). (CONF-870620—).

From Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Nashville, TN, USA (28 Jun 1987).

Technical Paper NT-87-12-2.

Strict control is essential over any emissions of radioactivity in the ventilation exhaust from facilities where radioactive materials may become airborne. At Los Alamos National Laboratory, 87 stacks exhaust ventilation air to the environment from operations with a potential for radioactive emissions. These stacks cover the diverse operations at all laboratory facilities where radioactive materials are handled and require continuous sampling/monitoring to detect levels of contamination. An overview is presented of the operations, associated ventilation exhaust cleanup systems, and analysis of the emissions. In keeping with the as-low-as-reasonably-achievable concept, emissions of radionuclides are reduced whenever practicable. A specific example is presented describing the reductions of emissions from the linear accelerator beam stop area at the Meson Physics Facility during 1985 by a factor of 8 over previous emissions.

5006 Regulations

REFER ALSO TO CITATION(S) 20322

20546 **(OE—8712) Stopping air pollution at its source. Discussion paper.** (Ontario Ministry of the Environment, Toronto (Canada)). 1987. 81p. (MICROLOG—88-05033). Ontario Ministry of the Environment, Communications Branch, 135 St. Clair Ave. West, 6th Floor, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Environment Ontario, through the Environmental Protection Act, Regulation 308, is responsible for achieving and maintaining a quality of the environment that will protect human health and the ecosystem. A government review of the air pollution control program found the regulation needed updating. A discussion paper of basic reforms of the Air Pollution General Regulation (Regulation 308) was prepared by the Ministry, outlining proposed amendments. This document contains an overview of proposed amendments; a summary of objectives; an outline of the new emission control strategy; proposals for implementation; and additional considerations including discussion of what kinds of pollution and polluters should come under these regulations. Proposed amendments include the replacement of dispersion by control of emissions at source, achieved by requiring polluters to control emissions to the degree appropriate for the contaminants they contain, with Certificates of Approval to operate renewable every 10 years; implementation of a method for ranking contaminants based on the toxicity, persistence, bioaccumulative and transport characteristics, and using at two-level or three-level control system; and the establishment of ambient air standards for various contaminants. 55 refs.

20547 **(OE—8712) Stopping air pollution at its source; Clean Air Program explanatory notes.** (Ontario Ministry of the Environment, Toronto (Canada)). 1987. 13p. (MICROLOG—88-05033). Ontario Ministry of the Environment, Communications Branch, 135 St. Clair Ave. West, 6th Floor, Toronto, ON, Canada 14V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An Ontario government review of its air pollution control program found that Regulation 308, the principal regulation relating to air pollution control, needed updating to provide additional protection to the people and environment. These explanatory notes provide a summary of the discussion paper, which presents an overview of the proposed amendments to Regulation 308 and a summary of objectives, in order to stimulate comments and criticism. The notes list the objections to the old regulation and briefly describe the objectives of the proposed amendments in the areas of emission limits, classification of contaminants, levels of pollution control, and ambient air standards. Definitions of terms and phraseology are also included.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

REFER ALSO TO CITATION(S) 20760

5101 Basic Studies

REFER ALSO TO CITATION(S) 19941, 20124, 20475, 20480

20548 (INIS-mf—11356, pp 46) **Natural /sup 14/C and / sup 13/C distribution patterns and organic matter dynamics in alfisols.** Becker-Heidmann, P.; Scharpenseel, H.W. (Hamburg Univ., Institut fuer Bodenkunde, Hamburg (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20549 (INIS-mf—11356, pp 74) **Neutron-activation of Eu-tagged soil.** Ernst, D.E.W. 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 19252, 19927, 20139, 20140, 20504, 20507, 20528, 20683, 20745, 20747

20550 **(CRIE-U—87082) Investigation on swelling characters of soils and on their utilizations.** Komine, Hideo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jul 1988. 63p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756465/JAW.

Swelling character of soils is only one character on soil classification as yet, but it begins attach importance to observe swelling character of soils because many accidents caused by swelling of soils occur recently. And the application of swelling character of soils for soil improvement and for making the artificial buffer mass on isolating rock-deposited high level radioactive waste products are considered. To deal with this problem, previous investigations are reviewed. Consequently, followings are cleared up. Swelling character is formulated by double layer theory, but the validity of this formulation is not evident yet. The environment such as temperature and chemistry of pore water affects this swelling character. At high density, swelling pressure of bentonite is very large and isn't greatly affected by the chemistry. Clay content affects the swelling character of soils. Hereafter, it will be necessary to be definite the relationship between swelling character and dynamical stability, and to develop the stability analysis method in consideration of swelling character. (68 figs, 6 tabs, 48 refs)

20551 **(EPRI-EN—6213) Screening of contamination potential and site cleanup at manufactured-gas plant and pole treatment sites: Final report.** Brown, S.M.; Peterson, B.; Antipas, A. (Electric Power Research Inst., Palo Alto, CA (USA); CH2M Hill, Bellevue, WA (USA)). Mar 1989. 91p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

ORGRISK was developed for use in evaluating the contamination potential posed by manufactured gas plant and pole treatment sites, as well as options for soil and groundwater cleanup. ORGRISK consists of a series of simple equations that relate chemical concentrations in soil, groundwater, and surface water. The equations are implemented in the form of four spreadsheet templates, one for contamination potential and soil cleanup evaluation and three for groundwater cleanup evaluation. The equations are solved using a personal computer spreadsheet program. The contamination potential template can be used to estimate chemical concentrations associated with a release to soil or groundwater and soil cleanup options. The groundwater cleanup template can be used to estimate concentrations associated with the extraction, treatment, and disposal of contaminated groundwater. Potential exposure levels can be estimated based on the concentrations calculated with ORGRISK. Initial guidance is provided on the estimation of parameters required by each template. Example case study applications to a manufactured gas plant and pole treatment site were conducted to demonstrate the use of ORGRISK. 6 refs., 8 figs., 31 tabs.

20552 **(EPRI-EN—6284) Chemical spill uncertainty analysis: Final report.** Shields, W.J.; Strecker, E.W.; Dean, J.D.; Brown, S.M. (Electric Power Research Inst., Palo Alto, CA (USA); CH2M Hill, Bellevue, WA (USA); Woodward-Clyde Consultants, Walnut Creek, CA (USA)). Mar 1989. 83p. Research Reports Center, Box 50490, Palo Alto, CA 94303.

MCPOSSM, a Monte Carlo simulation model for evaluating the variability of predicted chemical losses from a spill site is demonstrated. MCPOSSM was developed by linking a Monte Carlo parameter selection procedure with the PCB Spill On-Site Assessment Model (POSSM). POSSM is a chemical transport and fate model capable of considering all of the key processes controlling chemical losses from a spill site, including volatilization, leaching to groundwater, and chemical washoff from the land surface because of runoff and erosion. MCPOSSM was demonstrated using data from a hypothetical capacitor spill. The variability or uncertainty of nine MCPOSSM input parameters was evaluated. Soil parameters were bulk density, organic carbon content, field capacity moisture content, and wilting point moisture content. Chemical parameters were solubility, organic carbon partition coefficient and degradation rate. Variability due to estimating chemical spill volume and spill area was also evaluated. The variability of predicted chemical losses from the spill site is illustrated by cumulative frequency distributions and by plotting time series with associated confidence intervals. Conventional worst-case-analysis predictions are compared with the MCPOSSM results. 19 refs., 11 figs., 8 tabs.

20553 (IAEA-AL—004, pp 34) **Determination of pesticides and polychlorinated biphenyl congeners in mixed diet composites.** Schantz, M.M.; Chesler, S.N. (National Bureau of Standards, Gaithersburg, MD (USA). Organic Analytical Research Div.). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20554 (INIS-mf—11356, pp 56) **Mutation breeding to improve tolerance of Azolla towards aluminium toxicity.** Brunner, H. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20555 **(SSC/TB—1988) Glossary: acid rain.** (Department of the Secretary of State of Canada, Ottawa, Ontario. Translation Bureau). [1988]. 34p. (In Englich and French). (MICROLOG—88-04077). Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, Canada K1A 0S9; $3.95 OTHER COUNTRIES $4.75 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Some 100 basic concepts pertaining to acid rain are listed in this bilingual glossary, which is intended to facilitate communication in the Canadian public service and to provide the general public with useful new terminology. French and English terms are listed in the same alphabetical sequence, and equivalents in the other language are given for each term. 20 refs.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 19356, 19621, 19622, 19623, 20528, 20543, 20544, 20548, 20615, 20630, 20718, 20719, 20739

20556 **(DOE-RW—88.076) Natural analogue study of the distribution of uranium series radionuclides between the colloid and solute phases in the hydrogeological system of the Koongarra uranium deposit, Australia.** Ivanovich, M.; Duerden, P.; Payne, T. and others. (UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.; Australian Nuclear Science and Technology Organisation, Lucas Heights). (Department of the Environment, London (UK); UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.). Jan 1988. 127p. (AERE-R—12975). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705965/JAW.

In order to model realistically the subsurface transport of radionuclides it is necessary to fully characterise natural colloids in field samples. In this work samples of groundwaters, pure aqueous phase, particulate (> 1 μm particle diameter) and colloid phases were collected from five boreholes at the Koongarra uranium deposit, Australia, using an ultrafiltration system. These have been analysed in terms of their physical, chemical and actinide compositions, in order to determine the radionuclide fractions associated with each phase, as well as the colloid sizes and concentrations. The radiometric data are interpreted in terms of the isotopic equilibrium between the pure aqueous and colloid phases and the mineralogical/geochemical controls on the colloid radionuclide uptake.

20557 **(DOE-RW—88.081) Fracture mapping in clays: soil gas surveys at Down Ampney, Gloucestershire.** Gregory, R.G. (Exeter Univ. (UK)). (Department of the Environment, London (UK)). Feb 1988. 40p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705966/JAW.

At Down Ampney airfield, Gloucestershire, a faulted sequence of Jurassic sediments, comprising the Cornbrash (limestone), Kellaways Beds (sands and clays) and Oxford Clay (clay) is covered by about 5m of Pleistocene gravel capped by 1 m of soil. Soil gas samples from a depth of 0.5m were taken at intervals of 12.5m along eight traverses and 25m along one traverse, run approximately north-south. The samples were analysed for /sup 4/He, Rn, CO/sub 2/ and O/sub 2/. Anomalous concentrations of these gases were found in a number of linear zones trending approximately east-west. These define the positions of fractures. It is not possible to positively identify which of the fractures exhibit vertical displacements, but the most significant feature occurs about 50m north of the east-west runway. This is bounded by less well-developed fractures in a pattern consistent with a fault accompanied by subparallel minor fracturing. Consequently, the zone 50m north of the east-west runway is considered to be the main target for future work.

20558 **(DOE-RW—88.088) Fracture mapping in clays: the design and application of a mobile gas geochemistry laboratory for the analysis of soil gases.** Gregory, R.G. (Exeter Univ. (UK)). (Department of the Environment, London (UK)). Feb 1988. 66p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705967/JAW.

Integrated soil gas analyses for helium, radon, carbon dioxide, oxygen and organic gases allow the accurate interpretation of soil gas signatures as indicators of underlying structure. The most important features observed in the patterns of soil gas behaviour are large variations over faults and fractures. Structures such as these provide channelways for fluid movement in the upper crust. The construction of a mobile gas geochemistry laboratory for the analysis of soil gases at field investigation sites, and the subsequent trials carried out to evaluate the laboratory, clearly show that the soil gas investigation technique is accurate and viable as an independent site investigation method for the study of fracturing and groundwater movement around potential waste repository sites.

20559 **(DOE-RW—88.111) Assessment of low levels of radioactive contamination.** Gray, P.W. (Inscitech Consulting Ltd., Woking (UK)). (Department of the Environment, London (UK)). 25 Aug 1988. 134p. (INS—02/87). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705968/JAW.

This report describes a general methodology for the verification and clearance of sites contaminated with radioactive materials; general expressions for the risk or health detriment are derived. Techniques are developed, using Bayesian decision theory, to optimize the resources allocated to a site monitoring procedure, and to construct the probability distribution of the spatial distribution of specific activity within a site. A technique is also developed to determine the probability that a localized source of specified characteristics will not be detected by the monitoring procedure employed. The application of these techniques is illustrated by means of simple examples. This report confirms that a very large number of measurements are needed if a source of localized activity is to be detected with a high probability, and demonstrates how prior information about past radiological practices might be used to increase the probability of detection. Proposals are made for a programme of research to determine whether or not representative sites can be verified using current measuring techniques.

20560 **(FS—86-39-AKU/e) Radioactivity in the Federal Republic of Germany and in Switzerland after the reactor accident at Chernobyl. Results of a survey of the Working Group on Environmental Monitoring.** Winter, M.; Meyer, P.; Voelkle, H.; Narrog, J.; Kirchhoff, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Eidgenoessische Kommission zur Ueberwachung der Radioaktivitaet (KUER), Fribourg (Switzerland); Ministerium fuer Ernaehrung, Landwirtschaft, Umwelt und Forsten des Landes Baden-Wuerttemberg, Stuttgart (Germany, F.R.); Niedersaechsisches Landesamt fuer Immissionsschutz, Hannover (Germany, F.R.)). (Fachverband fuer Strahlenschutz e.V., Karlsruhe (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Ministerium fuer Ernaehrung, Landwirtschaft, Umwelt und Forsten Baden-Wuerttemberg, Stuttgart (Germany, F.R.)). Mar 1987. 79p. Fachverband fuer Strahlenschutz e.V., Karlsruhe (Germany, F.R.).

Translated from German.

English translation of the report FS--86-39-AKU already recorded in the database.

20561 (IAEA-AL—004, pp 37-41) **Chairman's remarks on the radionuclide session.** Schelenz, R.F. (International Atomic Energy Agency, Vienna (Austria). Dept. of Research and Isotopes). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20562 (IAEA-AL—004, pp 42) **Radionuclides, U.S. policy and findings after Chernobyl.** Gill, R. (Food and Drug Administration, Washington, DC (USA)). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20563 (IAEA-AL—004, pp 43) **Experience from the radioactive fallout in Sweden.** Hofsten, B. von. (Swedish National Food Administration, Uppsala (Sweden). Food Lab.). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nu-

trients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20564 (IAEA-AL—004, pp 45-46) **Measurement of radioactivity in food after the Chernobyl reactor accident experience accumulated and lessons learned.** Winter, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20565 **(IC—88/378) Local and global bifurcation and its applications in a predator-prey system with several parameters.** Jing Zhujun. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705996/JAW.

A predator-prey system, depending on several parameters, is investigated for bifurcation of equilibria, Hopf bifurcation, global bifurcation occurring saddle connection, and global existence and non-existence of limit cycles, and changes of the topological structure of trajectory as parameters are varied. (author). 8 refs, 4 figs.

20566 (INIS-BR—1411, pp 73-79) **Sampling and sample preparation of natural radionuclides.** Erat, S. (Landratsamt Karlsruhes (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Sampling and sample-preparation are important preliminary steps to obtain correct and reproducible analytical results. Different sampling-procedures for samples taken from water, soil, plants, and air as well as required pretreatment-technics are described for natural radionuclides.

20567 (INIS-mf—11356, pp 47) **Studies on the migration of /sup 137/Cs from the reactor accident of Chernobyl in soils in the region of Hamburg.** Becker-Heidmann, P.; Scharpenseel, H.W. (Hamburg Univ., Institut fuer Bodenkunde, Hamburg (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20568 (INIS-mf—11356, pp 54) **Studies on the role of soil biomass in the sorption of radioiodine.** Bors, J.; Martens, R. (Niedersaechsisches Inst. fuer Radiooekologie, Hannover (Germany, F.R.); Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany, F.R.). Inst. fuer Biochemie des Bodens). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20569 (INIS-mf—11356, pp 63) **Wheat radioactive contamination in the Italian territory with particular reference to the province of Piacenza as a consequence of the Chernobyl accident.** Carini, F.; Botteschi, G.; Silva, S. (Univ. Cattolica, Instituto di Chimica, Facolta di Agraria, Piacenza (Italy)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20570 (INIS-mf—11356, pp 73) **Use of Chernobyl field data in modelling cesium transfer to grassland crops.** Eriksson, A. (Swedish Univ. of Agricultural Sciences, Uppsala. Dept. of Radioecology). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20571 (INIS-mf—11356, pp 76) **Leaching of /sup 60/Co and /sup 134/Cs from the rooting zone of an experimental field.** Fagniart, E.; Colard, J.; Kirchmann, R. (S.C.K.-C.E.N., Mol (Belgium)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-3808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20572 (INIS-mf—11356, pp 135) **Depth distribution of radiocaesium in agricultural soils in Chernobyl fallout areas of Sweden in 1987-1988.** Loensjoe, H. (Swedish Univ. of Agricultural Sciences, Uppsala. Dept. of Radioecology). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20573 (INIS-mf—11356, pp 138) **Levels of /sup 137/Cs in Sweden 1986-88.** Mascanzoni, D. (Swedish Univ. of Agricultural Sciences, Uppsala. Dept. of Radioecology). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20574 (INIS-mf—11356, pp 140) **Distribution of fission radionuclides in cultivated soils of Styria after Chernobyl.** Meisel, S.; Graller, P.; Kahr, G.; Ninaus, W.; Mueller, H. (Technische Univ., Graz (Austria). Reaktorinstitut). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20575 (INIS-mf—11356, pp 147) **Contamination of food in the first and second year after the Chernobyl accident and its derived dose to the Austrian population.** Mueck, K. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20576 (INIS-mf—11356, pp 168) **Levels of activities and migrations of certain radionuclides in soil in the wider Sarajevo region.** Saracevic, L.; Kljajic, R.; Horsic, E.; Samek, D. (Univ. of Sarajevo, Veterinary Faculty, Institute for Radiology and Physical Therapy, Sarajevo (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20577 (INIS-mf—11356, pp 171) **Contamination of game in Austria after the Chernobyl accident and the 'transfer problem'.** Schoenhofer, F.; Tataruch, F. (Bundesanstalt fuer Lebensmitteluntersuchung und -forschung, Vienna (Austria); Forschungsinstitut fuer Wildtierkunde, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20578 (INIS-mf—11356, pp 159) **On the transfer of radiosilver from plant to animal.** Pfau, A.A.; Fischer, R. (Federal Research Centre of Agriculture, Institute of Animal Husbandry and Animal Behaviour, Neustadt a. Rbge. (Germany, F.R.); University Hospital Eppendorf, Institute of Physiological Chemistry, Department of Medical Biochemistry, Hamburg (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20579 (INIS-mf—11356, pp 82) **Radioecological pathway of elementary tritium after its deposition into top-soil.** Foerstel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20580 (INIS-mf—11356, pp 84) **Availability of deposited /sup 137/Cs to man.** Frissel, M.J.; Mattern, F.C.M.; Drost, R.M.S.; Keverling-Buisman, A.S.; Stoute, J.R.D. (National Institute of Public Health and Environmental Protection, Bilthoven (Netherlands); Netherlands Energy Research Centre, Petten (Netherlands)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20581 (INIS-mf—11356, pp 88) **/sup 137/Cs-uptake by plants from contaminated Austrian soils.** Gerzabek, M.H.; Ullah, S.M.; Mueck, K. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20582 (INIS-mf—11356, pp 113) **Cs-137 uptake as transfer (tf) into cereals in relation to properties of 17 soils.** Kerpen, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20583 (INIS-mf—11356, pp 141) **Contents of radiocesium 137 and radiostrontium 90 in broiler nutrients rich in soy.** Micic, G.; Draganovic, B. (Dept. of Radiology and Radiation Hygiene, Veterinary Faculty, Beograd (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20584 (INIS-mf—11356, pp 161) **Secondary standards in environmental radioactivity monitoring.** Popovic, D.; Djuric, G.; Spasic, V. (School of Veterinary Medicine, Dept. of Physics, Belgrade (Yugoslavia); School of Veterinary Medicine, Dept. of Radiology and Radiation Hygiene, Belgrade (Yugoslavia); Federal Bureau of Measures and Precious Metals, Belgrade (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20585 (INIS-mf—11356, pp 160) **Application of stable isotope ratio analysis to food surveillance and environmental research.** Pichlmayer, F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20586 **(ORNL/RASA—88/20) Results of the radiological survey at 266 East Spring Valley Avenue (MJ024), Hackensack, New Jersey.** Foley, R.D.; Crutcher, J.W.; Carrier, R.F.; Floyd, L.M. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008384/JAW.

As a result of the Energy and Water Appropriations Act of Fiscal Year 1984, the property discussed in this report and properties in its vicinity contaminated with residues from the former Maywood Chemical Works (MCW) were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE, by members of the Measurement Applications and Development Group of Oak Ridge National Laboratory. A radiological survey of the private, residential property at 266 East Spring Valley Avenue, Hackensack, New Jersey, was conducted during 1987. The survey and sampling of the ground surface and subsurface were carried out on April 23, 1987. 4 refs., 2 figs., 3 tabs.

20587 **(ORNL/RASA—88/22) Results of the radiological survey at 136 West Central Avenue (MJ030), Maywood, New Jersey.** Foley, R.D.; Crutcher, J.W.; Carrier, R.F.; Floyd, L.M. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008383/JAW.

As a result of the Energy and Water Appropriations Act of Fiscal Year 1984, the property discussed in this report and properties in its vicinity contaminated with residues from the former Maywood Chemical Works (MCW) were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE by members of the Measurement Applications and Development Group of Oak Ridge National Laboratory. A radiological survey of the private, residential property at 136 West Central Avenue, Maywood, New Jersey, was conducted during 1987. The survey and sampling of the ground surface and subsurface were carried out on April 29, 1987.

20588 **(ORNL/RASA—88/23) Results of the radiological survey at 200 State Route 17 (MJ035), Maywood, New Jersey.** Foley, R.D.; Crutcher, J.W.; Carrier, R.F.; Floyd, L.M. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008382/JAW.

The property discussed in this report and properties in its vicinity contaminated with residues from the former Maywood Chemical Works (MCW) were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE, by members of the Measurement Applications and Development Group of Oak Ridge National Laboratory. A radiological survey of the commercial property at 200

State Route 17, Maywood, New Jersey, was conducted during 1987. The survey and sampling of the ground surface and subsurface were carried out on September 2, 1987. 4 refs., 2 figs., 3 tabs.

20589 **(ORNL/RASA—88/24) Results of the radiological survey at Essex Street and State Route 17 (MJ036), Maywood, New Jersey.** Foley, R.D.; Crutcher, J.W.; Carrier, R.F.; Floyd, L.M. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008381/JAW.

As a result of the Energy and Water Appropriations Act of Fiscal Year 1984, the property discussed in this report and properties in its vicinity contaminated with residues from the former Maywood Chemical Works (MCW) were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE, by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory. A radiological survey of the commercial property at Essex Street and State Route 17, Maywood, New Jersey, was conducted during 1987. 4 refs., 2 figs., 3 tabs.

20590 **(RISO-R—549) Environmental radioactivity in Denmark in 1986.** Aarkrog, A.; Boetter-Jensen, L.; Chen Qing Jiang; Dahlgaard, H.; Hansen, H.; Holm, E.; Lauridsen, B.; Nielsen, S.P.; Soegaard-Hansen, J. (Risoe National Lab., Roskilde (Denmark)). Nov 1988. 274p. NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS. Order Number DE89780062/JAW.

Strontium-90, radiocesium and other radionuclides were determined in samples from all over the country of air, precipitation, stream water, lake water, ground water, drinking water, sea water, soil, sediments, dried milk, fresh milk, meat, fish, chese, eggs, grain, bread, potatoes, vegetables, fruit, grass, moss, lichen, sea plants, total diet, and humans. Estimates of the mean contents of radiostrontium and radiocesium in the human diet in Denmark during 1986 are given. Tritium was determined in precipitation, ground water, other fresh waters and sea water. The gamma-background was measured regularly by TLD, ionization chamber and on site gamma-spectroscopy at locations around Risoe, at ten of the State experimental farms, along the coasts of the Great Belt and around Gylling Naes. The marine environments at Barsebaeck and Ringhals were monitored for 137Cs and corrosion products (58Co, 60Co, 65Zn, 54Mn). The Chernobyl accident caused a substantial expansion of the environmental monitoring activities in Denmark. The programme was expanded to an extent similar to that in the sixties. (author) 178 tabs., 70 ills., 34 refs.

5105 Site Resource And Use Studies

20591 **(SREL—33) Wood storks of the Birdsville Colony and swamps of the Savannah River Plant: 1987 annual report.** Coulter, M.C. (Savannah River Ecology Lab., Aiken, SC (USA). Div. of Stress and Wildlife Ecology). May 1988. Contract AC09-76SR00819. 289p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007939/JAW.

The Savannah River Ecology Laboratory (SREL) Wood Stork program is a long-term program including various facets. It is primarily aimed at determining the importance of the Savannah River Swamp System (SRSS) to foraging storks and managing the Kathwood Foraging Ponds. We have examined the breeding biology of the birds at the colony to determine when the birds may have maximum food demand. We have also studied foraging ecology of the birds to allow us to develop a more effective management plan for the Kathwood ponds. The objectives were to determine the locations of foraging sites of Wood Storks from the Birdsville Colony and examine year-to-year variation in sites used; to characterize in more detail the habitat, vegetation, water quality and prey density/biomass at these sites; to observe the breeding birds to determine the times when food demands at the colony are greatest; to examine the movements of storks from the rookery to foraging sties and relate seasonal trends to the breeding biology; to examine the importance of the SRSS to foraging Wood Storks; and to examine the movements of individual birds to determine the generality of the observed patterns. 28 refs., 116 figs., 81 tabs.

20592 **(SRO—819-19) Savannah River Ecology Laboratory: Annual report of ecological research for the period ending July 31, 1988.** Strojan, C.L.; West, P.J. (eds.). (Savannah River Ecology Lab., Aiken, SC (USA)). Sep 1988. Contract AC09-76SR00819. 178p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007936/JAW.

This year the laboratory published 104 scientific papers in the peer-reviewed literature; an additional 82 are in press. SREL researchers also make numerous presentations at professional meetings and symposia, and at colleges and universities. SREL research concepts, techniques, and findings are presented to the general public through presentations at local civic and educational organizations and by publishing articles in popular magazines and newspapers. One of the highlights of this year is the construction of an addition to the SREL environmental chemistry laboratory. Located at the HWCTR facility, the 2400 square foot addition will allow SREL researchers to conduct research not easily done here now. Research at SREL is conducted by three primary research divisions: the Division of Biogeochemical Ecology, the Division of Stress and the Division of Wetlands Ecology. The biogeochemical Ecology Division researchers strive to understand the biogeochemical cycling of various contaminants in the environment. The Stress and Wildlife group focuses on the study of natural populations and communities of animals, with special emphasis on the influence of human-caused disturbances. The Wetlands Ecology group focuses on the study of biological community development and the factors that affect this development in natural and disturbed wetlands. Research is addressed by the research staff of each division in an interactive and collaborative manner.

5106 Regulations

20593 **(PB—89-133631/XAB) Superfund Amendments and Reauthorization Act (SARA): Section 313 roadmaps data base (for microcomputers). Data file.** Darr, J.; Neumann, J. (Environmental Protection Agency, Washington, DC (USA). Office of Toxic Substances). 31 Aug 1988. vp. NTIS CP D04.

The data file is contained on 5 1/4-inch diskettes, double density (360K), compatible with the IBM PC microcomputer. The diskettes are in the dBase III/CLIPPER compiler format. Price includes documentation, PB—89-133649.

EPA has developed a database of sources of information on the chemicals listed in section 313 of the Superfund Amendments and Reauthorization Act (SARA). The data base is intended to assist users of section 313 Toxic Release Inventory data to perform exposure and risk assessments of these chemicals. The roadmaps system displays and/or prints information for the SARA section 313 chemicals on health and environmental effects, Federal regulations, and state air and water regulations, monitoring data, and state contacts.

52 ENVIRONMENTAL SCIENCES, AQUATIC

REFER ALSO TO CITATION(S) 19435, 20760

5201 Basic Studies

REFER ALSO TO CITATION(S) 19462, 19463, 19464, 19465, 19466, 19467, 19544, 20592, 20744

20594 **(CRIE-U—87044) Simulation of seasonal change in plankton biomass in Lake Teganuma.** Yonekawa, Kazuhiko. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 27p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756461/JAW.

An ecological model was developed to simulate seasonal succession of plankton in Lake Teganuma which was heavily eutrophicated and bred in large quantity of plankton, and its conformability was investigated. Lake Teganuma was assumed as complete mixing type box model which is composed of phytoplankton of three kinds, zooplankton of two kinds and nitrogen, phosphorus. The extrinsic factors which have an effect on plankton were considered as follows; solar light, water temperature, nutrient salts load from river, the elution of nutrient salts from bottom mud, and inflow/outflow of water. This model simulated closely the pattern of seasonal change in plankton biomass, that is, diatoms bloomed in the fall and winter; green algae in the winter and spring; blue-green algae in the summer and early fall; cladocerans in the spring; rotifers dominated in the spring and fall. Calculated peaks of rotifer abundance were higher than observed ones, but calculated cladoceran abundance was close to observation. Calculated values of T-N, T-P concentrations were smaller than observed ones. (9 figs, 6 tabs, 18 refs)

20595 **(TR-EL—82-4/82(11.87)) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): Winter flounder.** Buckley, J. (Fish and Wildlife Service, Washington, DC (USA); Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group; Massachusetts Univ., Amherst (USA). Dept. of Forestry and Wildlife Management). Jan 1989. 19p. OSTI - U.S. Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89008103/JAW.

Species profiles are literature summaries of the taxonomy, life history, and environmental requirements of coastal fishes and aquatic invertebrates. They are designed to assist with environmental impact assessments. From 1935 to 1980, the annual commercial landings of winter flounder in New England ranged from 6000 to 15000 t; the sport catch exceeded the commercial catch in some years. Winter flounder are found in waters with temperatures of 0 to 25 {degree}C and they usually spawn at 0 to 3 {degree}C. Reported fecundities are 0.5 to 1.5 million eggs per female. Metamorphosis from larva to juvenile is complete in 49-80 days, depending on temperature. Juveniles remain in or near shallow natal waters for much of their first 2 years. Adults of some populations move more than 3 miles offshore to cooler waters in summer. These adults live in shallow inshore waters in winter and early spring. Adult winter flounder feed largely on annelids, cnidariids, and mollusks. 58 refs., 2 figs., 1 tab.

20596 **(TR-EL—82-4/82(11.90)) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Brown shrimp.** Larson, S.C.; Van Den Avyle, M.J.; Bozeman, E.L. Jr. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group; Fish and Wildlife Service, Washington, DC (USA); Georgia Univ., Athens (USA). Georgia Cooperative Fish and Wildlife Research Unit). Jan 1989. 20p. OSTI - U.S. Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89008100/JAW.

Species profiles are literature summaries of the life history, distribution, and environmental requirements of coastal fishes and invertebrates. Profiles are prepared to assist with environmental impact assessment. Brown shrimp (Penaeus aztecus) account for about one-third of the commercial shrimp harvest in the South Atlantic Region; the landing were worth $20 million in 1982. In the South Atlantic Region, commercially importance brown shrimp fishing grounds extend from Fort Pierce, Florida, to Pamlico Sound and Ocracoke Inlet, North Carolina. Most of the commercial harvest is taken inside the 10-fathom contour. Brown shrimp are omnivorous and eat food items ranging from detritus to small invertebrates and fishes. Many predators, including fishes and crustaceans, feed on brown shrimp. Brown shrimp survival is reduced by adverse temperature or salinities. Intertidal vegetation is an important characteristic of brown shrimp nursery areas. The suitability of some estuaries as nursery areas may be reduced by bulkheading, ditching, disposal of dredged materials, and drainage from agricultural and silvicultural areas. Existing estuarine areas must be preserved to ensure the continued production of brown shrimp. 57 refs., 2 figs., 2 tabs.

20597 **(TR-EL—82-4/82(11.91)) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Spot.** Hales, L.S.; Van Den Avyle, M.J. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group; Fish and Wildlife Service, Washington, DC (USA); Georgia Univ., Athens (USA). Georgia Cooperative Fish and Wildlife Research Unit). Jan 1989. 31p. OSTI - U.S. Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89008101/JAW.

Species profiles are literature summaries of the life history, distribution, and environmental requirements of coastal fishes and invertebrates. Profiles are prepared to assist with environmental impact assessment. The spot (Leiostomus xanthurus) is an abundant fish is coastal waters of the South Atlantic Region. It is important to commercial and recreational fisheries. In the South Atlantic Region, spot spawn commercial from October to March. The larvae are transported from the offshore spawning grounds to estuarine nursery areas. Juvenile spot initially congregate in shallow tidal creeks, but then disperse into deeper water as they get larger. Spot mature at 2-3 years of age. As larvae, spot feed on plankton, but switch to benthic invertebrates as juveniles and adults. Juvenile and adult spot are eaten by many other fishes. Tolerance to thermal shock and other environmental extremes varies with developmental stage. Alterations of the salinity or temperature regimes of an estuary may affect populations of spot; disturbances that affect the benthic community upon which spot feed may also affect spot abundance. Spot are not strong swimmers and may, therefore, suffer significant mortality due to intake structures at industrial or power generation plants. 127 refs., 2 figs.

20598 **(TR-EL—82-4/82(11.92)) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Amphipods.** Grosse, D.J.; Pauley, G.B. (Washington Univ., Seattle (USA). Cooperative Fishery Research Unit). Jan 1989. 27p. OSTI - US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89008274/JAW.

Species profiles are literature summaries of the taxonomy, morphology, distribution, life history, and environmental requirements of coastal aquatic species. They are prepared to assist in environmental impact assessment. Amphipods are ubiquitous in distribution, but are most abundant in estuarine areas and other high nutrient areas. Hyperiidea are the third most abundant coastal marine crustacean zooplankton, following copepods and euphausiids. Benthic Gammaridea are an invaluable food source for many economically important fish and invertebrate species. Habitat preference and behavior of the major amphipod groups is highly variable. Intertidal California amphipods overlap the distribution of common genera of other regions around the world. Amphipoda are reported to be indicators of heavily polluted areas. They are considered the most efficient of all scavengers on the sea bottom and in shoreline areas. 66 refs., 5 figs.

20599 **(TR-EL—82-4/82(11.93)) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): Ghost shrimp and blue mud shrimp.** Horning, S.; Sterling, A.; Smith, S.D. (Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center). Jan 1989. 14p. OSTI - US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89008273/JAW.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. The profiles are prepared to assist in environmental impact assessments. The ghost shrimp (Callianassa californiensis) and blue mud shrimp (Upogebia pugettensis) are common residents of intertidal mudflats of the Pacific Northwest, as well as of the entire West Coast of the contiguous United States. These species are decapod crustaceans, but not true shrimp. They are harvested as bait by recreational and commercial oyster-growing operations. Ghost shrimp larvae develop in summer in nearshore coastal waters and settle to the substrate surface, where they rapidly metamorphose; the life cycle of the blue mud shrimp is presumed to be similar. Both species spend their lives in burrows in

the mudflat, where the ghost shrimp is primarily a deposit feeder and the blue mud shrimp is a suspension feeder.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 19224, 19836, 20504, 20592, 20594

20600 **(DL—9299-02) CO/sub 2/ climate literature review. Phase 2, carbon cycle and oceans. Summary report.** (Dillon (M.M.) Ltd., Ottawa, Ontario (Canada)). 1984. 34p. (CE—02385). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document is intended to summarize the role of the oceans as they relate to the atmospheric concentration of carbon dioxide. Five major issues have been identified for more detailed discussion: transport of carbon in oceans, the use of tracers in ocean carbon storage studies, the role of sea ice in air/ocean carbon transfer, river transport of carbon to the oceans, and ocean carbon chemistry. Some general conclusions are as follows. The capacity of the ocean surface layer to take up additional CO/sub 2/ is limited by the supply of carbonate ion available to react with it. Thus the rate of CO/sub 2/ uptake will be determined largely by the nature and the rate of circulation to and from the deeper ocean. The densest water that penetrates to the greatest depths is formed at restricted locations, mainly in the Antarctic and North Atlantic. Precipitation of CaCO/sub 3/ from brines in annual high-latitude sea ice can also result in a direct CO/sub 2/ carbon transfer to the ocean depths. Photosynthesis in the photic zone reduces the amount of dissolved carbon and is largely controlled by nutrient concentration. Biologically induced changes in surface water composition probably have a major influence in reducing the amount of atmospheric CO/sub 2/. In investigating the ocean behavior of carbon, a limited number of radionuclides and chemical tracers have been found useful. As the CO/sub 2/ content of the atmosphere increases, it should become possible at some point to detect the resulting changes in seawater composition. Better understanding of increased atmospheric CO/sub 2/ effects would then follow. 57 refs., 1 tab.

20601 **(DPST—88-658) Steel Creek water quality: L Lake/Steel Creek Biological Monitoring Program, November 1985--December 1987.** Chimney, M.J.; Nagle, J.H. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 194p. (ECS-SR—74). NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007935/JAW.

The objective of this portion of the L-Lake/Steel Creek Biological Monitoring Program is to document the current status of water quality in the Steel Creek system, assess the overall impact of L-Reactor operation and L-Lake on Steel Creek water quality, determine whether ecologically important alterations in the water quality of Steel Creek have occurred, and compare Steel Creek water quality with other southeastern lotic systems. This report covers the period November 1985 through December 1987. The impoundment and discharge from L-Lake has had an impact on the water quality of Steel Creek through the introduction of Savannah River water into Steel Creek. Flow velocity throughout Steel Creek was related to the discharge volume at the L-Lake dam. This relationship was most evident at the creek corridor and channel stations.

20602 **(EPRI-EN—6238) Physiologic, toxicologic, and population responses of brook trout to acidification: Interim report of the lake acidification and fisheries project: Final report.** Mount, D.R.; Marcus, M.D. (eds.); Breck, J.E.; Christensen, S.W.; Gern, W.A.; Ingersoll, C.G.; Gulley, D.D.; McDonald, D.G.; Parkhurst, B.R.; Van Winkle, W. (Electric Power Research Inst., Palo Alto, CA (USA); Wyoming Univ., Laramie (USA). Dept. of Zoology and Physiology). Feb 1989. 147p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89008463/JAW.

This report overviews investigations of the "Lake Acidification and Fisheries" (LAF) project into the effects of surface water acidification on brook trout (Salvelinus fontinalis) populations. Of the six life stages examined, freshly-fertilized eggs were the most sensitive to reduced pH. In contrast, aluminum was most toxic to fry, juvenile, and adult fish. Increased calcium concentrations reduced the toxic effects of acid/aluminum exposure at all life stages. Little evidence was found to indicate that exposure to acidic waters affects oocyte development or production, suggesting that direct mortality plays a larger role in losses of brook trout populations from acidic waters. For fry and adult fish, the major toxic mechanism of acid/aluminum exposure seems to be disturbance of normal ion regulation at the gill, but aluminum exposure can cause respiratory impairment as well. Using results from LAF toxicity studies and available field data, a modeling framework was developed that predicts the probability of presence or absence of brook trout populations, based ion surface water chemistry. In addition, this framework can be used to evaluate changes in this probability caused by changes in water chemistry (e.g., liming), stocking rates, or fishing pressure. 129 refs., 37 figs., 8 tabs.

20603 **(G—1428-01) Massachusetts Water Resource Research Center: Annual program report, 1988 (FY 1987).** (Massachusetts Univ., Amherst (USA). Water Resources Research Center). Dec 1988. 63p. OSTI - Water Resources Research Center, University of Massachusetts, Blaisdell House, Amherst, MA 01003. Order Number TI89007345/JAW.

The Massachusetts Water Resources Research Center program for 1987-88 (Federal Fiscal Year FY87) focused on several research areas of high priority for the state and New England region: acid deposition impacts, the minimization of nitrate contamination of groundwater from on-site wastewater treatment, the pricing of drinking water to meet future infrastructure needs, and the proposed diversion of water from a "Wild and Scenic" river. Three WRIP Projects were begun in FY87. One evaluates cloud and fog acidity in central Massachusetts, another evaluates the use of peat in rural sewage disposal systems to minimize nitrate contamination of groundwater, and the third will determine the true cost of water so that utilities may appropriately plan for new sources or infrastructure renovation. The Cooperative Aquatic Research Program (CARP) funded five projects; four were acid deposition-related projects. Phase III of the Acid Rain Monitoring Project continued monitoring 500 randomly selected and 300 special interest surface waters quarterly and will continue into its fourth year of the ten year program. Investigation of the role of acid deposition in enhancing microorganisms in lake sediment that may play a role in methylating heavy metals such as mercury continued. Similarly, the study of mechanisms of control of aluminum mobility in watersheds subjected to acid deposition and the study of the impact of acid deposition on salamander communities were continued. Research on the role of sulfate reduction in lakes as a natural mechanism for neutralizing acidity funded in its first year by WRIP, has been continued. All but the Acid Rain Monitoring Project are to be completed in 1988.

20604 **(IAEA-AL—004(MONACO/36)) Intercalibration of analytical methods on marine environmental samples. Trace element measurements on fish homogenate (MA-B-3/TM).** (International Atomic Energy Agency, Monaco-Ville (Monaco). Lab. of Marine Radioactivity). Jun 1988. 60p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705454/JAW.

The pollution of the seas by various chemical substances constitutes nowadays one of the principal concerns of mankind. The International Atomic Energy Agency has organized in past years several intercomparison exercises in the framework of its Analytical Quality Control Service. The present intercomparison had a double aim: first, to give laboratories participating in this intercomparison an opportunity for checking their analytical performance. Secondly, to produce on the basis of the results of this intercomparison a reference material made of fish tissue which would be accurately certified with respect to many trace elements. Such a material could be used by analytical chemists to check the validity of new analytical procedures. In total, 53 laboratories from 29 countries reported results (585 laboratory means for 48 elements). 5 refs, 52 tabs.

20605 **(LBL—26542) Analysis of pumping test data of a leaky and layered aquifer with partially penetrating wells.** Yates, C.C. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 212p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008301/JAW.

Between the years 1981 and 1986, agricultural drainage water containing high concentrations of selenium, boron, and other salts was transported to the storage and evaporation ponds of Kesterson Reservoir, located in Merced County, California. Due to selenium poisoning of fish and migratory birds at the Reservoir, intensive scientific investigations of the surface water, groundwater, soils, sediments, and ecology were initiated. The preliminary groundwater investigations revealed that due to the leakage of the agricultural drainage water from the storage ponds down to the underlying shallow aquifer, saline and boron-rich contaminant plume had been created in the aquifer and was slowly migrating to the northeast. The primary purpose of this report is to determine the hydrologic properties of this underlying aquifer system. The field work was carried out at the LBLI/HO Site at Kesterson Reservoir. Initial hydrological pump test data and data from geophysical and lithological logs show that the shallow aquifer system is approximately 61 m (200 ft) thick and consists of a complex sequence of interbedded sands, silts, and clays bounded on the top by a leaky acquitard. The hydrologic test wells only partially penetrate the aquifer. Because of the complexity of this leaky and layered aquifer system with partially penetrating wells, fluid flow towards a production well will deviate from that of an ideal system. Choosing a pump test that will reveal these deviations in fluid flow is important in obtaining a complete data set for analysis. The four types of pump tests conducted at the LBLO/HO Site: were single-well steady-state tests, single-well transient tests, multiple-well standard interference tests, and multiple-well pulse tests. 45 refs., 59 figs., 17 tabs.

20606 **(NP—9770266) Modelling and monitoring of the transport of dissolved substances in tidal water.** Kappenberg, J. (Technische Univ. Hamburg-Harburg, Hamburg (Germany, F.R.)). 18 Dec 1987. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770266/JAW.

It was tried with simple model attempts to simulate the mechanisms of pollutant transportation in tide rivers (Elbe) and to control the water quality by means of monitoring systems. In particular, there were developed explicit models for the hydrodynamics in a channel-like river section in explicit (EXKA and ERKA) and implicit (IMKA) forms. The refined model MKMO was developed, in which the river is simulated by a number of parallel channels, as well as the model HAFEN, representing a network of channels and arms of rivers as it is typical for the Hamburg harbour. The physical transport was simulated partially in fixed (Euler-)coordinates (model EUTR) partially in a grid, which was transported by the current (Lagrangian coordinates, model LATR). The biochemical oxygen degradation was first simulated by combining all oxygen consumers in the BOD (biological oxygen demand) with a simple nonlinear Streeter-Phelps model. Then, a more accurate model was made of the oxygen depletion by organic nitrogen oxidation (nitrification), which is of special importance in the Elbe.

20607 **(SAND—89-0236C) Rapid destruction of organic chemicals in groundwater using sunlight.** Tyner, C.E.; Haslund, C.A.; Pacheco, J.E.; Holmes, J.T. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 8p. (CONF-890363—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006766/JAW.

From Hazardous materials management conference; Rosemont, IL, USA (14 Mar 1989).

We are currently investigating a solar-driven photocatalytic process that promises to destroy low concentrations of hazardous organic molecules in large volumes of contaminated groundwater or industrial waste streams. Preliminary results of laboratory-scale screening tests using a model compound, salicylic acid, and titanium dioxide catalyst have shown that no measurable reaction occurs without both uv light and catalyst; no measurable volatilization of the salicylic acid occurs at room temperature; salicylic acid destruction rates depend on catalyst supplier and concentration and on uv light intensity; and some intermediates are being formed and subsequently destroyed. Observed reaction rates are consistent with those observed in an initial pilot-scale solar test of a falling-film reactor, although further testing will be required to quantify the comparison. 10 refs., 5 figs.

20608 **(SNV—3388) Biological importance of humic material in acidified waters. A summary of the chemistry, biology and ecotoxicology of aquatic humus in acidified surface waters.** Petersen, R.C., Jr.; Hargeby, A.; Kullberg, A. (Lund Univ. (SE). Dept. of Ecology/Limnology). (National Swedish Environmental Protection Board, Solna). Dec 1987. 149p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757064/JAW.

Several lines of evidence suggest that the response of freshwater organisms to aquatic humus under acidified conditions is best described as a curvilinear, second order relationship. At low concentrations in acidified environments aquatic humus can bind with toxic metals, reduce membrane dysfunction caused by low pH, and in general protect, stimulate, or feed aquatic organisms to minimize the effects of acidification. At high concentrations humus itself becomes toxic. This is most likely due to increased permeability of cell membranes to lipophilic substances present in aquatic humus. An octanol/water partition coefficient has been developed and shown to be pH dependent, indicating that the hydrophobic character of humus can have biological meaning. The report is divided into two sections. First the methods and definitions of humus chemistry as they pertain to the biological importance of aquatic humus is discussed. Then the biological mechanisms of aquatic humus are presented. These sections form the basis for our main conclusions concerning the positive and negative effects of aquatic humus. (With 164 refs.) (authors).

20609 **(SNV—3465) Identification and distribution of chlorinated organic pollutants in the environment.** Reutergaardh, L. (National Swedish Environmental Protection Board, Solna). 1988. 76p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757066/JAW.

This thesis summarizes some gas chromatography techniques used for environmental studies of organic halogenated micropollutants. Insecticides such as DDT, hexachlorocyclohexanes, aldrin, dieldrin, toxaphene and the industrial pollutants HCB, PCB and PCT were readily extracted from sediments and biota with a multipolarity combination of solvents. The purification and preseparation were performed on silica gel or simply by partition with sulfuric acid or through saponification. Elemental sulfur in sediment impairing with the analysis was removed by an ionpair extraction. The methods developed were used in establishing geographical differences and time trends for the organochlorine contaminants. Statistically significant differences were found between spring and autumn samples of fish and seabirds, with lower concentrations in the autumn material. For sDDT and PCB the the environmental levels have decreased from the early 1970s until now, while the PCC concentration has remained constant. Today a steady state seems to prevail. The contaminants sDDT and PCB have reached levels where they impair the reproduction of top predators. Examples are given for the peregrine falcon and white-tailed sea eagle. A spatial difference of organochlorine contamination is seen in the aquatic environment with higher levels of most compounds in the Baltic Proper than elsewhere, while the PCC immission is the same. (With 117 refs.)

20610 **(SNV—3478) PMK - Groundwater. Progress report 1987.** Johnson, J. (Sveriges Geologiska Undersoekning, Uppsala). (National Swedish Environmental Protection Board, Solna). Sep 1988. 74p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88757069/JAW.

The project PMK-Groundwater is monitoring the quality of groundwater. The general objective is to detect long-term changes in the groundwater quality caused by diffuse air pollution. Samples are collected from 111 stations within 36 areas once to eight times a year. The following measurements and analyses are made: groundwater level, temperature, pH, conductivity, alkalinity, Na, K, Mg,

Ca, Al, NH/sub 4/, NO/sub 2/, NO/sub 3/, O/sub 2/, SO/sub 4/, F, Cl, Fe, Mn, Cd, Cr, Cu, Pb, Zn, COD/sub Mn/, SiO/sub 2/. The main activity during 1987 has been to sample and analyze groundwater from the stations. A geological map has been made of the station area of Tandoevala. In cooperation with the Swedish Meteorological and Hydrological Institute (SMHI), and the Swedish University of Agricultural Sciences (SLU), hydrochemical and hydraulic models have been applied to some time series collected within the project. A special study has been performed in order to examine the possibility of zink contamination of the samples from filtration. The lead values in the databank have been corrected. The values were underrated by an order of ten due to incorrect value of the standard sample used in the analysis. During the year, the pH and conductivity of the sampled groundwater were lower than normal. The low values are explained by high groundwater levels. Sulfate values were also low. At some stations in the southwestern part of Sweden the values of alkalinity, calcium, and magnesium were higher than the longterm average. A possible explanation were the relatively low groundwater levels that occurred during 1986.

20611 **(SNV—3479) PMK lakes and streams. Progress report 1987.** Wiederholm, T. (National Swedish Environmental Protection Board, Solna). Sep 1988. 29p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757070/JAW.

The water flow in streams and rivers was unusually high. Preliminary estimates indicate that the river loadings of NO/sub 3/-N on Kattegatt and Skagerack were higher than in any year since the present chemical monitoring network came into operation. Compared to the period 1971-85, conductivity was below or much below the normal at most stations in both northern and southern Sweden. The amount of dissolved organic matter was much above the normal at most stations. About one third of the stations had values higher than ever in 1981-85. Northern Sweden had NO/sub 3/-N concentrations much above the normal at nearly fifty percent of the stations. Alkalinity and pH were much below the normal at about 75% of the stations in nortern Sweden. Lower than normal biomasses of phytoplankton were recorded in the large lakes. No mass development of bluegreens was found. The cold and windy weather seems to have favoured several diatoms. Small chrysophycean flagellates were also abundant. A review of PMK data from Lake Vaenern and its tributaries shows that the phosphorus loading is presently about 25% lower than during the sixties. The nitrogen loading from rivers in agricultural areas has not changed much during the last 10-15 years but the loading from many rivers draining forested areas has increased relative to water flow. In lake Vaettern, the total phosphorus concentration has decreased on average 0.10 μg/l and year since 1969. The trend of increasing concentrations of nitrogen continued during 1987. A comparison with data from 1939 indicate that the lake has a greater bicarbonate deficit than fifty years ago. During the last 12 years, the deficit has been decreasing, however, and the buffering capacity has not been critically low at any time.

20612 **(TR-EL—82-4/82(11.89)) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): Pacific razor clam.** Lassuy, D.R.; Simons, D. (Oregon State Univ., Corvallis (USA). Dept. of Fisheries and Wildlife; Washington Dept. of Fisheries, Montesano, WA (USA). Coastal Lab.). Jan 1989. 25p. OSTI - US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89008102/JAW.

Species profiles are literature summaries of the taxonomy, morphology, distribution, life history, ecological role, fishery (when appropriate), and environmental requirements of coastal aquatic species. They are prepared to assist coastal managers, engineers, and biologists in the gathering of information pertinent to coastal development activities. The Pacific razor clam has a long history of human consumption on the West Coast. Turn-of-the-century commercial canning operations have given way to today's extensive recreational fishery. Razor clams spawn in late spring and early summer in the Pacific Northwest and recruit to flat, sandy beaches in late summer. Greatest densities of large clams occur in the lower intertidal zone. Razor clams grow and mature faster but attain a lower maximum size and age in the southern part of their range. They are noted for their unusual ability to dig very rapidly through the subsurface sand. Silt-generating activities should be avoided in the vicinity of razor clam beaches, as juveniles are susceptible to suffocation. 32 refs., 2 figs., 2 tabs.

20613 **Environmental fate of Hg and /sup 137/Cs discharged from Oak Ridge facilities.** Turner, R.R.; Olsen, C.R.; Wilcon, W.J. Jr. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp v of Trace substances in environmental health-XVIII. Hemphill, D.D. Columbia, MO; University of Missouri Extension Information (1984). (CONF-8406143—).

From 18. annual conference on trace substances in environmental health; Columbia, MO, USA (4 Jun 1984).

As a result of past DOE activities on the Oak Ridge Reservation, Oak Ridge, Tennessee, about 110 metric tons (Mg) of Hg and over 500 curies of /sup 137/Cs were discharged into the Tennessee River reservoir system between 1949 and 1982. Although different facilities and unrelated operations contributed the two contaminants, the highest annual discharge (33 Mg Hg, 170 Ci /sup 137/Cs) for both occurred within a 2-year period (1956-1957). The distribution of Hg and /sup 137/Cs was measured in river-reservoir sediment cores recently collected from 50 to 200 km downstream from the Oak Ridge site. The vertical profiles of Hg and /sup 137/Cs in these cores are strongly correlated with documented discharge histories and thus can provide a means of dating specific horizons in the sedimentary deposits. In downstream areas, sediment chronologies based on reservoir age and the distribution of naturally occurring /sup 210/Pb are concordant with chronologies based on the vertical Hg and /sup 137/Cs profiles. The chronologies helped to resolve mercury contributions from a chloralkali plant located about 150 Km downstream of the Oak Ridge site.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 19356, 19362, 19619, 20113, 20544, 20590, 20592

20614 **(DOE-RW—88.035) Characterisation of humic material for inter-laboratory comparison.** Peachy, D.; Bradley, A.D.; Davis, A.E.; Stuart, M.E.; Tait, B.A.R.; Vickers, B.P.; Williams, G.M. (British Geological Survey, London (UK). Mineral Resources and Applied Geochemistry Research Group; British Geological Survey, Keyworth (UK). Fluid Processes Research Group). (Department of the Environment, London (UK)). Jan 1988. 21p. (FLPU—87-5). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705963/JAW.

The characterisation and interlaboratory comparison of common humic materials by members of the European Commission's COCO group (set up to study complexes and colloids), forms part of a study of the effects of natural organic compounds in groundwater on the complexation and mobility of radionuclides. Three samples have been characterised: a sodium salt and a protonated form of the commercially available humic acid from Aldrich Chemicals; and a protonated humic acid from the Gorleben research site in Germany. Characterisation undertaken by BGS includes moisture content, elemental analysis, metal content, functional group analysis, infra-red spectroscopy, ultra-violet absorbance (E/sub 4//E/sub 6/ ratios), and ultra-filtration.

20615 **(EPA—520/5-88-017) Radiological survey of the Norfolk Naval Station, the Norfolk Naval Shipyard, and Newport News Shipbuilding.** Sensintaffar, E.L.; Blanchard, R.L. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Oct 1988. 27p. OSTI - Enviromental Protection Agency, Office of Radiation Programs, 401 M Street SW, Washington, DC 20460. Order Number TI89008503/JAW.

Since 1963, the Eastern Environmental Radiation Facility (EERF), US Environmental Protection Agency (USEPA), in cooperation with the US Naval Sea Systems Command (NAVSEA) has surveyed facilities serving nuclear-powered warships on the Atlantic and Pacific coasts and the Gulf of Mexico. These surveys assess whether the operation of nuclear-powered warships, during construction, maintenance, overhaul, or refueling, have created elevat-

ed levels of radioactivity. The surveys emphasize sampling those areas and pathways that could expose the public. In 1984, NAVSEA requested that EPA survey all active facilities servicing nuclear-powered warships over the next three years. This report contains the results of surveys conducted at Norfolk Naval Shipyard, Norfolk Naval Station and Newport News Shipbuilding during the period July 28 to August 1, 1986. Some of these same areas were previously surveyed by EERF personnel (at that time US Public Health Service) in January 1968. 1 ref., 4 figs., 5 tabs.

20616 (IAEA-TECDOC—481, pp 7-50) **Assessment of the inventory of carbon-14 in the oceans. An overview.** Lassey, K.R.; Manning, M.R.; O'Brien, B.J. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Oct 1988. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705464/JAW.

In Inventories of selected radionuclides in the oceans.

The report overviews an earlier treatise (INS-R--348, Nov 1986) on the oceanic distribution of /sup 14/C of both cosmogenic and bomb origin. The total oceanic inventory of cosmogenic /sup 14/C is assessed at 1.96x10/sup 30/ atoms (7500 PBq). The bomb-carbon inventory as of 1972 is assessed at 303x10/sup 26/ atoms (116 PBq), based on analysis by Broecker, Peng, Ostlund and Stuiver. The atmospheric source of /sup 14/C and its flux between atmosphere and ocean is discussed and quantified, from which the post-1972 transfer of bomb-carbon to the oceans is estimated to have bolstered the inventory there to 435x10/sup 26/ atoms (167 PBq) by 1985. (author). 82 refs, 5 figs, 5 tabs.

20617 (IAEA-TECDOC—481, pp 51-69) **Inventory of /sup 137/Cs and /sup 90/Sr in the world's oceans.** Whitehead, N.E. (International Atomic Energy Agency, Monaco-Ville (Monaco). Lab. of Marine Radioactivity). Oct 1988. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705464/JAW.

In Inventories of selected radionuclides in the oceans.

This paper estimates /sup 137/Cs inventories in the oceans of the world in 1972-1974, and attempts in some cases a rough material balance for individual oceans. The balance is found rather poor for the Arctic which contains larger amounts than predicted. The total world inventory is 637+-70 PBq and 30 PBq are in the sediments. The total is in statistical accord with the estimated fallout deposition of 637 PBq excluding estimated close-in fallout of 125-195 PBq. The estimated /sup 90/Sr inventory for the oceans is 439+-48 PBq. (author). 55 refs, 1 fig., 5 tabs.

20618 (IAEA-TECDOC—481, pp 71-102) **Artificial radioactivity in the North Sea and the northern North Atlantic during the years 1977 to 1986.** Kautsky, H. (Deutsches Hydrographisches Inst. (DHI), Hamburg (Germany, F.R.)). Oct 1988. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705464/JAW.

In Inventories of selected radionuclides in the oceans.

Data are presented for /sup 134,137/Cs, /sup 90/Sr, /sup 239,240/Pu, /sup 238/Pu, /sup 241/Am and /sup 3/H in the North Sea during 1977-1985. /sup 3/H distribution tends to differ from that of the other radionuclides. Seasonal effects are noted. The /sup 137+134/Cs inventory in 1984 was 2,400 TBq. Transport times calculated are: 3 years from Sellafield to the Pentland Firth, 6-7 to Spitsbergen and 7-9 to East Greenland. Some data from analyses following the Chernobyl accident are given. (author). 26 refs, 16 figs, 12 tabs.

20619 (IAEA-TECDOC—481, pp 103-137) **Worldwide data on fluxes of /sup 239,240/Pu and /sup 238/Pu to the oceans.** Aarkrog, A. (Risoe National Lab., Roskilde (Denmark)). Oct 1988. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705464/JAW.

In Inventories of selected radionuclides in the oceans.

The world's oceans contain 16 PBq of /sup 239,240/Pu, and the expected inventory is 12 PBq from weapons testing. The Irish Sea contains 0.3 PBq in the sediments. The discrepancy between measurements and expectations may be due to an under-estimate for fallout in rain. Data for /sup 238/Pu are scarce. (author). 75 refs, 8 figs and tabs.

20620 (IAEA-TECDOC—481, pp 139-158) **Lead-210 and polonium-210 in the world's oceans.** Cherry, R.D.; Heyraud, M. (Cape Town Univ. (South Africa). Dept. of Physics; International Atomic Energy Agency, Monaco-Ville (Monaco). Lab. of Marine Radioactivity). Oct 1988. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705464/JAW.

In Inventories of selected radionuclides in the oceans.

After a brief summary of the sources of /sup 210/Po and /sup 210/Pb in the ocean, the published data for these two nuclides are discussed in four sections. 1. Surface sea water (≦ 100 m) from the open ocean. 2. Surface sea water from coastal regions. 3. Depth profiles in the open ocean. 4. Data from atypical regions. Estimates of the global inventories of /sup 210/Po and /sup 210/Pb are made and compared with the /sup 226/Ra inventories (Bojanowski, this volume). Over the whole water column in the three major oceans /sup 210/Po and /sup 210/Pb are in approximate equilibrium. The global inventory of /sup 210/Pb in the water column is estimated to be 2895+-517 PBq or 61+-11% of that of /sup 226/Ra. (author). 46 refs, 5 figs, 3 tabs.

20621 (IAEA-TECDOC—481, pp 159-181) **Inventory of radium isotopes in the oceans.** Bojanowski, R. (Polish Academy of Sciences, Sopot (Poland). Inst. of Oceanology). Oct 1988. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88705464/JAW.

In Inventories of selected radionuclides in the oceans.

Inventories are derived for /sup 226/Ra in the oceans, using profile data from the literature, especially the GEOSECS cruises. Several methods yielded identical results within statistical error. Recommended values are: Atlantic Ocean (including the Arctic) 0.84 +- 0.10 E 18 Bq; Pacific 2.92 +- 0.16 E 18 Bq; Indian 1.02 +- 0.09 E 18 Bq; giving a grand total of 4.78 +- 0.27 E 18 Bq. Losses from radioactive decay of 2.046 E 15 Bq y/sup -1/ are approximately balanced by the flux from the sea floor. Losses from the sea surface are about E 10 Bq y/sup -1/. River input is about 0.42 E 15 Bq y/sup -1/ and ground water influx provides 3-22 E 13 Bq y/sup -1/. The errors are sufficiently large, that no departures from equilibrium caused by anthropogenic activities can be demonstrated. (author). 101 refs, 7 tabs, 2 figs.

20622 **(IAEA-TECDOC—482) Prevention and mitigation of groundwater contamination from radioactive releases.** (International Atomic Energy Agency, Vienna (Austria)). Oct 1988. 81p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705465/JAW.

This document gives basic information on potential pathways and mechanisms, by which radioactive materials from releases can reach man, and on modelling considerations to predict the behaviour of radioactive materials in the ground. The main objective is to present an overview of existing techniques for preventing the offsite releases of contaminants into the groundwater systems and techniques for mitigation of effects of such releases should they occur. The recommended techniques are fully applicable to any hazardous materials, such as organic liquids, and toxic materials or otherwise dangerous materials, the presence of which in the accessible biosphere can represent health risks as well as economic losses to the general public. 11 refs, 2 figs, 8 tabs.

20623 (INIS-mf—11356, pp 35) **Cs-137 uptake in aquatic vegetation of Styria (Austria).** Ahamer, G.; Mueller, H. (Technische Univ., Graz (Austria). Reaktorinstitut). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20624 (NAGRA-NTB—87-10) Boreholes Boettstein, Weiach, Riniken, Schafisheim, Kaisten, Leuggern (Northern Switzerland). Influnce of technical and hydrogeological conditions on the sampling periods of ground water. Wittwer, C. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Aug 1988. 173p. (In French). Nagra, CH-5401 Baden, Switzerland.

The hydrogeological research programme carried out by the National Cooperative for the Storage of Radioactive Waste (NAGRA) included more than 60 sampling campaigns of groundwaters in six deep boreholes (1.3 to 2.5 km) in northern Switzerland. The sampling campaigns were carried out after isolating well-defined intervals of the sedimentary section and the crystalline basement using packers linked to the surface by tubing. In order to determine the pollution of the groundwaters by the drilling fluids, two artificial tracers (uranine and mTFMBA) were added in known quantities to the drilling fluids, which consist most of the time of deionised water. The concentration of these two tracers was then measured during the whole clean-up period which precedes the sampling itself. This report considers the parameters (duration and volume of drilling fluid loss, duration and volume of artesian flow before the tests, pumped volumes and reference concentration of the tracers in the drilling fluids) which have been recognised as playing an important role during the sampling and which influence the restitution of the tracers. To allow a quantitative study of these relationships, the duration and volume of drilling fluid loss and artesian flow were determined for each interval. The pumped volumes, measured at the surface, were corrected to obtain the actual volumes extracted from the rock. The relative concentrations of the tracers were calculated on the basis of their reference values in the drilling fluid and the background of the intervals before the tests. Unfortunately, the compiled values do not allow quantitative conclusions to be drawn on the effect of parameters linked top the drilling activities on the evolution of the sampling periods; this is due to imprecision in field measurements and the variability of drilling conditions. 35 refs., 25 figs., 63 tabs.

20625 (ORNL/M—637) Radionuclide distributions and sorption behavior in the Susquehanna--Chesapeake Bay System. Olsen, C.R.; Larsen, I.L.; Lowry, P.D.; McLean, R.I.; Domotor, S.L. (Oak Ridge National Lab., TN (USA); Maryland Dept. of Natural Resources, Annapolis (USA). Power Plant and Environmental Review Div.). Jan 1989. Contract AC05-84OR21400. 111p. (PPER-R—12). NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008088/JAW.

Radionuclides released into the Susquehanna--Chesapeake System from the Three Mile Island, Peach Bottom, and Calvert Cliffs nuclear power plants are partitioned among dissolved, particulate, and biological phases and may thus exist in a number of physical and chemical forms. In this project, we have measured the dissolved and particulate distributions of fallout ^{137}Cs; reactor-released ^{137}Cs, ^{134}Cs, ^{65}Zn, ^{60}Co, and ^{58}Co; and naturally occurring ^{7}Be and ^{210}Pb in the lower Susquehanna River and Upper Chesapeake Bay. In addition, we chemically leached suspended particles and bottom sediments in the laboratory to determine radionuclide partitioning among different particulate-sorbing phases to complement the site-specific field data. This information has been used to document the important geochemical processes that affect the transport, sorption, distribution, and fate of reactor-released radionuclides (and by analogy, other trace contaminants) in this river-estuarine system. Knowledge of the mechanisms, kinetic factors, and processes that affect radionuclide distributions is crucial for predicting their biological availability, toxicity, chemical behavior, physical transport, and accumulation in aquatic systems. The results from this project provide the information necessary for developing accurate radionuclide-transport and biological-uptake models. 76 refs., 12 figs.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 20592

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 20591, 20592

5206 Regulations

REFER ALSO TO CITATION(S) 20593

20626 (MISA—1988) The public review of the draft effluent monitoring regulations for the petroleum refining sector and the [Ontario] Ministry of the Environment's response to it. (MISA Priority Pollutants Task Force). 1988. 78p. (MICROLOG—88-05335). Ontario Government Publications, Publications Services, 880 Bay Street, 5th. Floor, Toronto, ON, Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Effluent monitoring regulations are to be developed with federal government, industry, and public participation within each industrial sector. The Effluent Monitoring Regulation for the Petroleum Refining Sector was released for public comment in July 1987. Comments were received from private citizens, environmental interest groups, government agencies, industries, industrial associations, research companies, professional consulting companies, and a university. The major issues raised by the public included concern about the composition and maintenance of the effluent monitoring priority pollutants list; suggested implementation of the Daphnia magna acute lethality toxicity test; the importance of the listing/delisting process and the necessity to develop a mechanism for it; suggested monitoring and auditing of data gathered and by industry by the Ministry of the Environment; public involvement in the various stages of the Municipal/Industrial Strategy for Abatement (MISA); and a system of laboratory accreditation. Responses to these issues were prepared by Ministry staff. Several amendments have been made to the draft regulation and it has been split into two regulations: general and petroleum refining sector.

20627 (MISA—1988) Effluent monitoring regulations for the petroleum refining sector. (MISA Priority Pollutants Task Force). 1988. 152p. (MICROLOG—88-05333). Ontario Government Publications, Publications Services, 880 Bay Street, 5th. Floor, Toronto, ON, Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document contains all legal monitoring requirements for Ontario's petroleum refining sector. "Ontario Regulation 358/88: Effluent Monitoring - General" provides the technical and scientific methodologies for monitoring that are applicable to all dischargers under MISA (Municipal/Industrial Strategy for Abatement). "Ontario Regulation 359/88: Effluent Monitoring - Petroleum Refining Sector" states the chemical monitoring, toxicity testing, flow measurement, and reporting requirements that each refinery must meet as of December 1, 1988. Sampling points must be established on every process, emergency overflow, once-through cooling water, and stormwater effluent stream. Routine chemical monitoring requirements and the specific contaminants to be monitored are presented. Toxicity testing using both rainbow trout and Daphnia magna are required. Part two of the document presents the environmental background to MISA and the main features of the program, the effluent monitoring priority pollutants list, the principles of monitoring, and a description of the petroleum refining sector in Ontario. A technical rationale for the refinery monitoring requirements and their economic implications are also discussed.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 20562

20628 **(INA—8201) Green Paper: the Landcaster Sound region, 1980-2000. Issues and options on the use and management of the region.** Dirschl, H.J. (Department of Indian and Northern Affairs, Ottawa, Ontario (Canada)). 1982. 102p. (CE—02378). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

As a foundation for a comprehensive regional planning process for Lancaster Sound, a study was prepared for the purpose of fostering full public discussion of a number of issues of importance to the native population of the area and relevant to resource conservation and development. The impetus for such a study came from the increasing interest in the Sound as a shipping route for oil and gas and as a region of possible hydrocarbon exploration and other industrial developments. This paper provides a summary of existing knowledge on the physical and biological environment, the current socio-economic situation, and the range of current and potential uses of the study area. The paper also puts forward for discussion some alternative strategies or options that appear to be available for the use, development and management of the region for the remainder of the century. One of the major concerns identified by the study pertains to the environment and its continued use by the Inuit, who would prefer a stable economy based on renewable resource use. The Sound's biological productivity is of global significance and the area will require comprehensive protection measures. The future options for the area assessed in this paper are: no new development of any kind; protection of environment and biological resources to be assured before any further resource use projects are permitted; development of the renewable resource base; development of the Northwest Passage as a year-round shipping route; balanced development of renewable and non-renewable resources; and a non-renewable resource economy. 3 refs., 19 figs.

20629 **(IAND—QS-8297-010EE-A1) People, resources and the environment. Perspectives on the use and management of the Lancaster Sound Region.** Jacobs, P. (Department of Indian Affairs and Northern Development, Ottawa, Ontario (Canada)). 1981. 69p. (CE—02379). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Lancaster Sound, at the eastern end of the Northwest Passage, is the richest and most biologically productive area in the Canadian high Arctic. The natural resources of the area continue to support an important population of native peopole. Recently, attention has been focused on the need to transport important discoveries of oil, gas and minerals through the Sound, and it has been discovered that the geological structure beneath the eastern sector of the Sound may contain significant hydrocarbon reservoirs. The relationship between the natural and human environment on one hand and the interest in the area for energy related developments has brought about a need for a review of policies for future management of the region. A Green Paper on resource management has been compiled, and a public review of that paper's draft has been completed. This report reviews the perspectives of a broad range of Canadians who have expressed both interest and concern for the Lancaster Sound region and who have responded to questions on the future plans for the Sound. In the public hearing process, four main questions were considered, relating to industrial development, parks and reserves, shipping of oil and gas, and resource development. A number of differing options and strategies applicable to resolving each of these questions are presented, and recommendations on resource management and planning are given. 46 refs., 22 figs.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 19543, 20563, 20564

20630 (IAEA-AL—004, pp 44) **Activities of the IAEA programme: Fallout radioactivity monitoring in environment and food.** Klusek, C. (Department of Energy, New York (USA). Environmental Measurements Lab.). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

55 BIOMEDICAL SCIENCES, BASIC STUDIES

20631 **(SNV—3512) Monitoring of contaminants in living organisms. Progress report 1987.** Odsjoe, T.; Olsson, M. (Naturhistoriska Riksmuseet, Stockholm (Sweden)). (National Swedish Environmental Protection Board, Solna). Sep 1988. 49p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757071/JAW.

The report summarizes the PMK program for monitoring of contaminants within the four main sectors: 1. Trend monitoring programme, 2. Reference material programme, 3. Program for Species threatened by contaminants, 4. Environmental Specimen Bank. The Trend monitoring programme is divided in three subprograms; terrestrial, limnological and marine programme respectively. The marine part is further divided in an open sea and a coastal programme. Besides an account of the 1987 activities, the report comprises a preliminary evaluation of the trend in the occurrence of heavy metals and chlorinated hydrocarbons in fish from marine environments. (U.W.).

5502 Biochemistry

REFER ALSO TO CITATION(S) 19171, 19450, 19477, 19486, 19489

20632 **(ANL/PPRNT—89-109) Expression of viral and virus-like elements in DNA repair-deficient/immunodeficient "wasted" mice.** Gavinski, S.; Woloschak, G.E. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008453/JAW.

Wasted mice bear an autosomal recessive mutation (wst) that causes neurological abnormalities, faulty DNA repair in lymphocytes, and immunodeficiency at mucosal sites. Recent work has suggested possible viral involvement in these manifestations by demonstration abnormal viral gp70 expression that segregates with the wasted mutation. In the experiments reported here, we examined tissue-specific expression of AKR viral (AKV) sequences and virus-like VL30 elements in wasted and control mice. Our studies showed that AKV and VL30 RNA expression were two- to five-fold higher in spleen, brain, and thymus of mice bearing wst allele than in those of control mice. These tissues have all been shown to display functional or developmental abnormalities in wst/wst mice. Expression of viral mRNA in Peyer's patches and mesenteric lymph nodes was similar in wastes and control animals. The majority of the VL30-hybridizing RNA in all tissues could be attributed to long terminal repeat (LTR) rather than main body sequences. These differences in expression between wasted and control mice could not be attributed to differences in VL30 or AKV gene copy number. Our results demonstrate an association between altered expression of viral and virus-like sequences and the development of tissue-restricted abnormalities in (wst/wst) mice. 21 refs., 6 figs., 4 tabs.

20633 **(DOE/ER/13574—2) [Pyruvate decarboxylase: A key enzyme for alcohol production]: [Annual] performance report.** Ingram, L.O. (Florida Univ., Gainesville (USA)). [1989]. Contract FG05-86ER13574. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008086/JAW.

The overall objectives of this grant are to investigate the properties and regulation of pyruvate decarboxylase from Z. mobilis and to identify the unique features which allow its high level of expression. Steps in the project include enzyme purification and antibody production, characterization of physical and kinetic properties, investigations of how environmental conditions affect the level of pyruvate decarboxylase, it's biosynthesis and turnover, cloning and sequencing, investigations of the effects of increased gene dosage, control of m-RNA synthesis and turnover, and promoter structure. 11 refs.

20634 **(DOE/ER/13574—3) Ethanologenic enzymes of Zymomonas mobilis: Progress report.** Ingram, L.O. (Florida Univ., Gainesville (USA). Dept. of Microbiology and Cell Science). 1 Feb 1989. Contract FG05-86ER13574. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008087/JAW.

In this study, we have proposed to investigate the regulatory mechanisms which permit the high level expression of the ethanologenic enzymes from Zymomonas mobilis (PDC, ADHI, ADHII). This research is continuing essentially as proposed in the original grant except that the scope is being expanded to include the glycolytic enzymes which are also highly expressed. Several enzymes which are expressed only at moderate levels are being examined for comparison (tryptophan biosynthesis, acid phosphatase). Studies of highly expressed genes involve enzyme purification and the production of antibodies, investigations of the effects of growth conditions on expression, cloning and characterization of structural genes, construction of hybrid genes, mutation of alcohol dehydrogenases, and investigation of transcriptional and translational regulation. In addition, we are investigating the feasibility of replacing the NAD regeneration systems of other bacteria with an artificial operon containing the Z. mobilis genes (PDC and ADHII) for the production of ethanol, the "PET" operon. 30 refs.

20635 **(DOE/ER/60700—T1) Multiplex sequencing and cosmid mapping: Progress report.** Gesteland, R.F. (Utah Univ., Salt Lake City (USA). Dept. of Human Genetics). 1988. Contract FG02-88ER60700. 3p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007710/JAW.

The multiplexing project has progressed on two fronts. Multiplex dideoxy sequencing has been refined and another group is nearly ready to do a bench mark sequence of the maize mitochondrial genome (450kb) to get a real estimate of the speed and efficiency of the method. The 16 overlapping cosmids containing the whole genome have been subcloned onto 3200 clones on 64 multiplexing vectors, which have been divided into 50 fold mixtures. After electro blotting onto 80 membranes, the sequences can be retrieved by probing with P 2-poly-dA-tailed oligos. The turn around time for probing, washing exposing and stripping is about 24 hours. We are building an automated system that has the membranes on the inside of a large rotating drum so that all the steps of the probing cycle are carried out without having to handle the membranes and keeping the hybridization solution to a minimum. The second front is the construction of a florescence array detector that we hope will allow us to replace the P32 probe with a fluorescent probe that will increase speed of detection and add another level of multiplexing.

20636 **(DOE/FTR—9008098) [10th international congress on photobiology, Tel Aviv, Israel, October 27, 1988--November 4, 1988]: Foreign trip report.** Setlow, R.B. (Brookhaven National Lab., Upton, NY (USA)). 23 Feb 1989. Contract AC02-76CH00016. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008098/JAW.

The purpose of the trip was to attend the 10th International Congress on Photobiology. The Congresses are held every four years and bring together many interacting disciplines and researchers. Subjects range from plants to humans with extensive work on molecules, viruses, and single cells. People attend from most parts of the world and there is an excellent interchange of information. Much of the research work in ultraviolet photobiology overlaps conceptually with radiation biology. Indeed, it was the original detailed understanding of ultraviolet photobiology that has led to our knowledge about DNA repair mechanisms and has layed the ground work for a lot of the quantitative understanding of ionizing radiation effects. The fact that humans deficient in the ability to repair ultraviolet damage to their DNA are at an approximate 10,000-fold greater risk than normal people from sunlight-induced skin cancer is the best available evidence that damage to the DNA of people may be the most important step in carcinogenesis.

20637 **(LBL—26242) Chemical Biodynamics Division FY 88 annual report, 1 October 1987--30 September 1988.** Bartholomew, J.C. (Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098. 97p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008848/JAW.

Research programs in biochemistry from Lawrence Berkeley Laboratory are briefly described. Specific areas are in chemical sciences, biological energy, environmental research and development. (CBS)

20638 **(NP—9770271) Neutron diffraction experiments for the investigation of biological membrane structures and membrane model systems. Final report.** Bueldt, G.; Hentschel, M.P.; Heyn, M.P.; Mischel, M.; Ploehn, H.J.; Seiff, F.; Wallat, I.; Westerhausen, J. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1985. 14p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770271/JAW.

Our experiments concentrate on the three following questions with regard to biological diaphragms: the lipid structure: the natural mixture of phosphatidyl glycerol was won from Escherichia coli and deuterized in the γ positions of the glycerol backbone and glycerol head group. From the position of the two labels and by the help of the 2H NMR information, an orientation of the phosphoglycerol head group of 30/sup 0/ to the diaphragm plane could be determined. The diaphragm-water boundary layer: The profile distribution of the deuterizable tetramethylammonium cation to the negatively charged diaphragm surface of a pure phosphatidyl glycerol bilayer was determined. In another series of experiments, the distribution of the same cation in the plane of the purple diaphragm of Halobacterium halobium was investigated. The structure of integral diaphragm proteins: In the case of porin from the outer diaphragm of Escherichia coli, the relative location of the tunnels in the trimer could be obtained by H/sub 2/O/D/sub 2/O exchange experiments. The investigations on the bacteriorhodopsin of Halobacterium halobium aimed at determining the position of the chromophore retinal, deuterized at different places. Furthermore, special amino acids were provided with deuterizable labels in order to determine, from the known aminoacid sequence, the helices in the structure to which these labels are bound. Finally it was tried to mark the loops between the helices with suitable cations in order to determine their position in the structure.

20639 **(PNL—6828) Evaluation of terrestrial microcosms for detection, fate, and survival analysis of genetically engineered microorganisms and their recombinant genetic material.** Fredrickson, J.K.; Seidler, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1989. Contract AC06-76RL01830. 152p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008479/JAW.

The research included in this document represents the current scientific information available regarding the applicability of terrestrial microcosms and related methodologies for evaluating detection methods and the fate and survival of microorganisms in the environment. The three terrestrial microcosms described in this document were used to evaluate the survival and fate of recombinant bacteria in soils and in association with plant surfaces and insects and their transport through soil with percolating water and root systems, and to test new methods and procedures to improve

detection and enumeration of bacteria in soil. Simple (potting soil composed of peat mix and perlite, lacking environmental control and monitoring) and complex microcosms (agricultural soil with partial control and monitoring of environmental conditions) were demonstrated to be useful tools for preliminary assessments of microbial viability in terrestrial ecosystems. These studies evaluated the survival patterns of Enterobacter cloacae (pBR322) in soil and on plant surfaces and the ingestion of this same microorganism by cutworms and survival in the foregut and frass. The Versacore microcosm design was used to monitor the fate and competitiveness of genetically engineered bacteria in soil. Both selective media and gene probes were used successfully to follow the fate of two recombinant Pseudomonas sp. introduced into Versacore microcosms. Intact soil-core microcosms were employed to evaluate the fate and transport of genetically altered Azospirillum sp. and Pseudomonas sp. in soil and the plant rhizosphere. The usefulness of these various microcosms as a tool for risk assessment is underscored by the ease in obtaining soil from a proposed field release site to evaluate subsequent GEM fate and survival.

20640 **Surface site diffusion and reaction on molecular organizates and colloidal catalysts: a geometrical perspective.** Politowicz, P.A.; Kozak, J.J. (Univ. of Oxford (England)). *Proceedings of the National Academy of Sciences of the United States of America;* **84**: No. 23, 8175-8179(Dec 1987).

The authors study surface-mediated, diffusion-controlled reactive processes on particles whose overall geometry is homeomorphic to a sphere. Rather than assuming that a coreactant can diffuse freely over the surface of the particle to a target site (reaction center), they consider the case where the coreactant can migrate only among N-1 satellite sites that are networked to the reaction site by means of a number of pathways or reaction channels. Five distinct lattice topologies are considered and they study the reaction efficiency both for the case where the satellite sites are passive and for the case where reaction may occur with finite probability at these sites. The results obtained for this class of surface problems are compared with those obtained by assuming that the reaction-diffusion process takes place on a planar, two-dimensional surface (lattice). The applicability of their results to surface-mediated processes on organizates (cells, vesicles, micelles) and on colloidally dispersed catalyst particles is brought out in the Introduction, and the correspondence between the lattice-based, Markovian approach developed here and Fickian models of surface diffusion, particularly with regard to the exponentiality of the decay, is discussed in the concluding section.

20641 **Nucleotide sequence of the gene from the cyanobacterium Anacystis nidulans R2 encoding the Mn-stabilizing protein involved in photosystem II water oxidation.** Kuwabara, T.; Reddy, K.J.; Sherman, L.A. (Univ. of Missouri, Columbia (USA)). *Proceedings of the National Academy of Sciences of the United States of America;* **84**: No. 23, 8230-8234(Dec 1987). Contract FG02-86ER13516.

The gene for the Mn-stabilizing protein (MSP; the so-called extrinsic 33-kDa protein) that is involved in photosystem II water oxidation was cloned and sequenced from the genome of the cyanobacterium Anacystis nidulans R2. The gene (here designated woxA) was shown to be present in a single copy. The deduced amino acid sequence indicated that the translation product consisted of 277 amino acid residues with a M/sub r/ of 29,306. The comparison of the sequence with that of mature MSP from spinach chloroplasts suggested that the translation product is a precursor whose amino-terminal 28 amino acid residues represent the signal peptide for the protein to cross the thylakoid membrane into the lumen. The length of the putative signal peptide was less than half that of the transit peptide for thylakoid-lumenal proteins of higher plants, whereas the structural profile of the putative signal peptide was similar to that of the carboxyl-terminal portion of the higher plant transit peptide. The amino acid sequence of the mature A. nidulans R2 MSP showed rather low homology (48-49%) to higher plant MSPs, but the conserved amino acid residues appeared to be clustered. Five clusters were tentatively assigned, in which the homology values were in a range of 66-70%. Domains essential for the functioning of MSP are expected to be situated in these clusters. It is of note that the two cysteine residues in MSP were conserved, and the disulfide linkage between them may play an important role in maintaining the tertiary structure of MSP.

20642 **Two enzymes involved in biosynthesis of the host-selective phytotoxin HC-toxin.** Walton, J.D. (Michigan State Univ., East Lansing (USA)). *Proceedings of the National Academy of Sciences of the United States of America;* **84**: No. 23, 8444-8447(Dec 1987). Contract AC02-76ER01338.

Cochliobolus carbonum race 1 produces a cyclic tetrapeptide HC-toxin, which is necessary for its exceptional virulence on certain varieties of maize. Previous genetic analysis of HC-toxin production by the fungus has indicated that a single genetic locus controls HC-toxin production. Enzymes involved in the biosynthesis of HC-toxin have been sought by following the precedents established for the biosynthetic enzymes of cyclic peptide antibiotics. Two enzymatic activities from C. carbonum race 1 were found, a D-alanine- and an L-proline-dependent ATP/PP/sub i/ exchange, which by biochemical and genetic criteria were shown to be involved in the biosynthesis of HC-toxin. These two activities were present in all tested race 1 isolates of C. carbonum, which produce HC-toxin, and in none of the tested race 2 and race 3 isolates, which do not produce the toxin. In a genetic cross between two isolates of C. carbonum differing at the tox locus, all tox^+ progeny had both activities, and all tox^- progeny lacked both activities.

5503 Cytology

20643 **Monoclonal antibodies to human glycophorin a and cell lines for the production thereof.** Vanderlaan, M.; Bigbee, W.L.; Jensen, R.H.; Fong, S.S.N.; Langlois, R.G. (to Dept. of Energy, Washington, DC). US Patent 4,752,582. 21 Jun 1988. Filed date 29 Nov 1984. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

Cloned mouse hybridoma cell lines have been established which continuously produce antibodies that are highly specific to and exhibit high affinity for glycophorin A/sup N/ and differentiate between the M and N forms of human glycophorin A.

5504 Genetics

REFER ALSO TO CITATION(S) 19450, 20632, 20633, 20634, 20635, 20637, 20639, 20750

20644 **Genetic transfer in Desulfovibrio desulfuricans.** Rapp, B.J.; Wall, J.D. (Univ. of Missouri, Columbia (USA)). *Proceedings of the National Academy of Sciences of the United States of America;* **84**: No. 24, 9128-9130(Dec 1987). Contract FG02-87ER13713.

An apparently defective bacteriophage capable of mediating transduction has been identified in culture filtrates of Desulfovibrio desulfuricans (American Type Culture Collection 27774). Phage-mediated intraspecies transfer of antibiotic resistance markers occurs with a frequency of 10^{-4} to 10^{-6} per recipient cell. The vector contains linear fragments of double-strained DNA of about 13.5 kilobase pairs, which appear to be random pieces of bacterial DNA. As yet, neither induction nor plaque formation has been observed. To the authors' knowledge, a system of genetic exchange has not been described before for a member of the sulfate-reducing bacteria.

5505 Metabolism

REFER ALSO TO CITATION(S) 20648

20645 (INIS-mf—11356, pp 121) **Hemogram in the radioactive phosphorus (/sup 32/P) treated chickens.** Kraljevic, P.; Emanovic, D.; Mitin, V. (Dept. of Physiology and Radiobiology Veterinary Faculty, Zagreb (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20646 (INIS-mf—11356, pp 172) **Measurement of acetate production in domestic animals by stable-isotope-mass-spectrometry.** Schulze, E.; Giese, W.; Sallmann, H.P.; Breves, G. (Tierarztliche Hochschule Hannover (Germany, F.R.); Federal Research Centre of Agriculture, Braunschweig (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

5506 Medicine

REFER ALSO TO CITATION(S) 19635, 20206, 20207, 20716, 20725, 21589

20647 **(ANL/PPRNT—89-172) Bromine-80m-labeled estrogens: Auger-electron emitting, estrogen receptor-directed ligands with potential for therapy of estrogen receptor positive cancers.** DeSombre, E.R.; Mease, R.C.; Hughes, A.; Harper, P.V.; DeJesus, O.T.; Friedman, A.M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008478/JAW.

A triphenylbromoethylene, 1,1-bis(p-hydroxyphenyl)-2-bromo-2-phenylethylene, Br-BHPE, and a bromosteroidal estrogen, 17α- bromovinylestradiol, $BrVE_2$, were labeled with the Auger electron emitting nuclide bromine-80m, prepared by the [p,n] reaction with ^{80}Se. To assess their potential as estrogen receptor (ER) directed therapeutic substrates the bromine-80m labeled estrogens were injected into immature female rats and the tissue distribution studied at 0.5 and 2 hours. Both radiobromoestrogens showed substantial diethylstilbesterol (DES)-inhibitable localization in the ER rich tissues, uterus, pituitary, ovary and vagina at both time points. While the percent dose per gram tissue was higher for the Br-BHPE, the $BrVE_2$ showed higher tissue to blood ratios, especially at 2 hr, reflecting the lower blood concentrations of radiobromine following administration of the steroidal bromoestrogen. Comparing intraperitoneal, intravenous and subcutaneous routes of administration for the radiobromine labeled Br-BHPE, the intraperitoneal route was particularly advantageous to provide maximum. DES-inhibitable concentrations in the peritoneal, ER-rich target organs, the uterus, ovary and vagina. While uterine concentrations after BrBHPE were from 10--48% dose/g and after $BrVE_2$ were 15--25% dose/g, similar treatment with /sup 80m/Br as sodium bromide showed uniform low concentrations in all tissues at about the levels seen in blood. The effective specific activity of [/sup 80m/Br]BrBHPE, assayed by specific binding to ER in rat uterine cytosol, was 8700 Ci/mmole. 23 refs., 9 figs., 2 tabs.

20648 **(CEA-CONF—9673) Modelisation of /sup 11/C-methionine PET kinetics in the human brain.** Mazoyer, B.M.; Levasseur, M.; Syrota, A.; Prenant, C.; Baron, J.C.; Sette, G.; Verrey, B.; Samson, Y. (CEA, 91 - Orsay (France). Service Hospitalier Frederic Joliot). 1988. 4p. (CONF-880834—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756991/JAW.

From 1. congress of the European Association of Nuclear Medicine; Milan, Italy (29 Aug 1988).

The compatibility of five compartmental models with /sup 11/C-Methyl-L-Methionine brain kinetics obtained with PET in 16 fasted subjects were compared. Using the Akaike's Information Criterion, the classical 3-compartment 3-rate constant model was found significantly less compatible with the data than either a 3-compartment 4-rate constant model or than 4-compartment 5 rate-constant models ($p \leqq .005$, sign test). A minimum of four rate constants appears to be necessary for an accurate description of /sup 11/C-methyl-L-methionine human brain kinetics over 48 minutes.

20649 **(CEA-CONF—9674) Improved estimation of receptor density and binding rate constants using a single tracer injection and displacement.** Syrota, A.; Delforge, J.; Mazoyer, B.M. (CEA, 91 - Orsay (France). Service Hospitalier Frederic Joliot). 1988. 4p. (CONF-880834—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756992/JAW.

From 1. congress of the European Association of Nuclear Medicine; Milan, Italy (29 Aug 1988).

The possibility of improving receptor model parameter estimation using a displacement experiment in which an excess of an unlabeled ligand (J) is injected after a delay (t/sub D/) following injection of trace amounts of the β/sup +/ - labeled ligand (J*) is investigated. The effects of varying t/sub D/ and J/J* on parameter uncertainties are studied in the case of /sup 11/C-MQNB binding to myocardial acetycholine receptor using parameters identified in a dog experiment.

20650 **(DOE/ER/40374—15) Design study of a medical linac for neutron therapy.** Raparia, D.; Machida, S. (Houston Univ., TX (USA). Dept. of Physics). 1988. Contract FG05-87ER40374. 12p. (CONF-881151—53). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007392/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A 66 MeV proton linac for neutron therapy has been studied and conceptual designs for low energy beam transport (LEBT), a radio frequency quadrupole (RFQ), and a drift tube linac (DTL) have been achieved. The machine is compact and simple enough to be operated in hospitals. The LEBT consists of two Einzel lenses and is 22 cm long. The 425 MHz RFQ is designed for 50 milliamps peak current at 60 Hz and is one meter long. The 18-meter-long DTL has the same frequency as the RFQ and uses permanent quadrupole magnets. Beam dynamics are very important for this compact and high-brightness machine. This paper emphasizes our investigation of the beam dynamics. 5 refs., 4 figs., 3 tabs.

20651 **(DOE/ER/60561—3) New techniques for positron emission tomography in the study of human neurological disorders: Progress report, 15 June 1988--14 December 1988.** Kuhl, D.E. (Michigan Univ., Ann Arbor (USA). Div. of Nuclear Medicine). Feb 1989. Contract FG02-87ER60561. 8p. NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89008572/JAW.

A variety of 11C-labeling methodologies and handling techniques were developed including reductive ^{11}C-methylation (10) captive solvent methylations (22), improved solid phase method for conversion of ^{11}C-MeOH to - $^{11}CH_3I$(2) a simple colorometric assay for CH_3I (1) and small faster devices for remote PET radiolabeling (3). Development of a reliable all-silver pressurized water target for production of very large quantities of reactive [^{18}F]fluoride (9). Pressurization of the target with hydrogen during irradiation prevent boiling and losses due to radiolysis and allows very efficient ^{18}F production that is proportional with beam current up to at least 35 μA. More recently this same target system has been used to produce $^{13}NH_3$ directly in-target in very good yields (19). 35 refs.

20652 **(EGG-M—88038) Conceptual design of a medical therapy reactor facility.** Lake, J.A.; Neuman, W.A.; Jones, J.L.; Parsons, D.K.; Drexler, R.L.; Hobbins, R.R.; Lussie, W.G.; Griebenow, M.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 6p. (CONF-8705326—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005194/JAW.

From 3. international symposium on neutron capture therapy; Bremen, F.R. Germany (31 May 1987).

A comprehensive research program for neutron capture therapy (NCT) is planned in the United States (US) using the 28 MWt Power Burst Facility (PBF) reactor at the Department of Energy's (DOE) Idaho National Engineering Laboratory (INEL). If this research successfully demonstrates feasibility for treating a variety of cancer types that are not well-controlled by existing modalities, there will be a need to deploy the neutron therapy technology at major medical centers worldwide. The need for widespread deployment raises several issues associated with nuclear reactor technology for this application. These issues include cost, usability by the medical community, safety, and licenseability. With this ultimate deployment in mind, we have initiated conceptual design studies of a Medical Therapy Reactor (MTR) for production of neutron beams for NCT. 1 ref., 2 figs.

20653 **(FNAL/C—88/178) A hospital-based proton linac for neutron therapy and radioisotope production.** Lennox, A.J. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 3p. (CONF-881049—66). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007479/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Fermilab's Alvarez proton linac has been used routinely for neutron therapy since 1976. The Neutron Therapy Facility (NTF) operates in a mode parasitic to the laboratory's high energy physics program, which uses the linac as an injector for a synchrotron. Parasitic operation is possible because the linac delivers {approximately}1.2 {times} 10^{13} protons per pulse at a 15 Hz rate, while the high energy physics program requires beam at a rate not greater than 0.5 Hz. Protons not needed for physics experiments strike a beryllium target to produce neutrons for neutron therapy. Encouraging clinical results from NTF have led to a study of the issues involved in providing hospitals with a neutron beam of the type available at Fermilab. This paper describes the issues addressed by that study. 12 refs., 1 fig., 1 tab.

20654 **(GSI—88-71(Prepr.)) Medical heavy ion therapy project at the Gesellschaft fuer Schwerionenforschung facility in Darmstadt.** Gademann, G.; Wannenmacher, M.; Hartmann, G.H.; Lorenz, W.J.; Kraft, G. (Heidelberg Univ. (Germany, F.R.). Radiologische Klinik; Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Abt. Biophysik und Medizinische Strahlenphysik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Dec 1988. 19p. (CONF-8810326—). Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

From International workshop on particle therapy; Essen, F.R. Germany (28 Oct 1988).

The Radiologische Universitaetsklinik (Radiological University Hospital) and the Deutsches Krebsforschungszentrum (German Cancer Research Centre, DKFZ) in Heidelberg, in collaboration with the Gesellschaft fuer Schwerionenforschung (Laboratory for Heavy Ions, GSI) in Darmstadt, have developed a concept to use the new heavy ion synchrotron (Schwerionen-Synchroton SIS) in Darmstadt for medical-clinical irradiations. Due to the high flexibility of the SIS accelerator the medical program can be performed in addition to the planned physical experiments with minor interference only. The close geographical proximity of the three institutes involved and the accelerator which will be completed by the end of 1989 provide the unique opportunity to carry out relevant clinical, medical-physical, physical-technical, and radiobiological research in a relatively short time and, compared to similar projects in other countries, at low cost.

20655 (INIS-mf—11356, pp 163) **Use of hormone radioimmunoassays in developing countries.** Richards, J.; Plaizier, K.; Perera, B.M.A.O. (Joint FAO/IAEA Div., Animal Production and Health Section, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20656 **(INIS-mf—11361) Brain SPECT with Tl-201 DDC.** Bruine, J.F. de. (Amsterdam Univ. (Netherlands)). 21 Apr 1988. 148p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706059/JAW.

The development, animal and human experiments and the first clinical results of a new blood flow tracer thallium-201 diethyldithiocarbamate (Tl-201 DDC) are discussed for functional brain imaging with single-photon emission computed tomography (SPECT). 325 refs.; 43 figs.; 22 tabs.

20657 **(INIS-mf—11362) Late health effects of radiation for Eustachian tube dysfunction. A non-concurrent prospective study.** Verduijn, P.G. (Erasmus Univ., Rotterdam (Netherlands)). 15 Jun 1988. 170p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706060/JAW.

Includes Dutch summary.

A non-concurrent cohort study is described in which the effects of the Crowe therapy were examined with regard to the health of a population of persons who were irradiated in their youth. 284 refs.; 16 figs.; 45 tabs.

20658 **(INIS-mf—11371) Models for the calculation of electron beam dose distributions in radiotherapy.** Mathol, W.A.F. (Amsterdam Univ. (Netherlands). Lab. voor Medische Fysica). Jun 1986. 99p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88706069/JAW.

Irradiation treatment of cancer patients employing high-energy electron beams generated by a linear accelerator with an energy range from 6 to 20 MeV is discussed. A mathematical method to calculate absorbed dose distributions and output factors for an arbitrarily shaped electron beam within the specified accuracy (3% in dose and 3 mm in position for isodose lines and 2.5% for output factors) has been developed. A physical model for the electron beam transport in water has been developed. The lateral dose distributions of a pencil beam can be calculated and shows good agreement with Monte Carlo results at all depths. Further possibilities of the model are the calculation of the angular distributions of a pencil beam and the calculation of depth dose curves. 40 refs.; 47 figs.; 5 tabs.

20659 **(INIS-mf—11376) Aspects of salivary gland scintigraphy with /sup 99m/Tc-pertechnetate.** Akker, H.P. van den. (Amsterdam Univ. (Netherlands)). 21 Jan 1988. 124p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706074/JAW.

Includes Dutch summary.

An outline of the normal pattern of /sup 99m/Tc-pertechnetate uptake and excretion by the major salivary glands is presented, followed by a description of the criteria used in qualitative and semi-quantitative classifications based on a visual interpretation of sequential scintigraphic images. Various aspects of the radioactivity appearing in the region of the oral cavity after intravenous injection of /sup 99m/Tc-pertechnetate were investigated. The feasibility was shown of reducing the scintigraphic examination time from the usually recommended 60 minutes or longer to 30 minutes by administering a salivary stimulant at 10 instead of 20 minutes after pertechnetate injection, and by terminating the scintigraphic study 20 minutes after stimulation. The potentials and limitations of sialography, scintigraphy with /sup 99m/Tc-pertechnetate, ultrasound, CT and MRI are discussed and a rational approach to their use is recommended. 248 refs.; 37 figs.; 8 tabs.

20660 **(ORNL/TM—11014) Nuclear medicine program: Progress report for quarter ending June 30, 1988.** Knapp, F.F. Jr.; Ambrose, A.P.; Callahan, A.P.; Allred, J.F.; Blystone, S.L.; Lisic, E.C.; McPherson, D.W.; Srivastava, P.C.; Rice, D.E.; Rogers, C.J.; Umbricht, G. (Oak Ridge National Lab., TN (USA)). Feb 1989. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007882/JAW.

This report describes our initial studies on developing techniques of attaching radioisotopes of copper (Cu-64 and Cu-67) and rhenium (Re-186 and Re-188) to proteins. Our work has focussed on the synthesis of para-carboxyalkylphenylglyoxal-bis-(N_4-methylthiosemi-carbazone) ligands (TSC). Because of the strong binding of Cu(II) to the bis-TSC ligand, the development of bifunctional chelates for attachment of radioisotopes of copper to antibodies is of interest. We have developed an improved synthesis of the requisite α-ketoaldehyde and 1,2-diketone substrates used for derivatization to the bis-TSC ligand chelates. This approach uses the "Kornbloom" method which provides a simple alternative to the usual method for fabrication of the 1,2-bis-thiosemicarbazone compounds and avoids the use of selenium dioxide for oxidation of substituted acetophenones. Acylation of the -phenyl carboxylic acid with bromoacetyl chloride or 2-bromopropionyl chloride followed by treatment with silver nitrate readily provides the nitrate esters. Oxidative elimination with sodium acetate in DMSO then provides the α-ketoaldehyde or 1,2-diketo products. The overall yields are in the 40-60% range. Also in this report are the results of studies with the Langendorff-perfused rat heart system. Comparison of the incorporation of [I-131]IPPA and [I-125]BMIPP in dual-labeled studies

under normoxia and hypoxia (pO_2 > 120 mm) clearly showed the expected preferential incorporation into triglyceride (TG) storage products. Basic hydrolysis of the TG fraction purified by chromatography showed release of the radioactivity into products chromatographing in the free fatty acid fraction.

20661 (PER—164) **3. Congress of the SA Society of nuclear medicine: Technetium-99m technology.** Beyers, M. (ed.). (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). Aug 1988. 45p. (CONF-8808197—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705936/JAW.

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

The Atomic Energy Corporation of SA Limited have been engaged in the manufacture of radioisotopes since 1967, shortly after the SAFARI-1 reactor at Pelindaba was commissioned. Since then the use of radioisotopes in South Africa has grown rapidly and at present 95% of the in vivo diagnostic radioisotopes (radiopharmaceuticals) utilized in nuclear medicine are manufactured locally. Because radioisotopes are applied mainly in sophisticated chemically or mechanically processed forms, production requires not only a skilled production team, but also the appropriate facilities for the manufacture of high-quality products which comply with the necessary safety standards. Compliance with such standards is especially important for the routine production of radiopharmaceuticals for use in nuclear medicine. Over the past 20 years technetium-99m has achieved a dominant position among the diagnostic tools in modern nuclear medicine.The scope of nuclear medicine is expanding continuously and its future lies primarily in the development of new organspecific technetium-99m radiodiagnostic agents. Many improvements and changes have been made to Tc-99m generators, the major source of Tc-99m, since they were introduced to nuclear medicine in the late 1950's. The new Peltek-F sterile Tc-99m generator developed by the Isotope Production Centre is a symbol of progress made. In order to commemorate the launching of the new Peltek-F technetium-99m generator during August 1988 it was decided to publish six papers that were presented at the Third Congress of the Society of Nuclear Medicine held at Bloemfontein during the period 15 - 17 August 1988 by members of the Isotope Production Centre. This will serve as a useful reference on various aspects of technetium-99m technology and will stimulate the use of this product as well as new research in this field.

20662 (PER—164, pp 17-21) **New technetium-99m radiopharmaceuticals for brain imaging.** Knoetsen, O. Aug 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705936/JAW. (CONF-8808197—).

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

Radiopharmaceuticals for brain imaging are used for the detection of ischemia, tumours and dementia associatied with disorders of the blood flow in the brain. The current radiopharmaceuticals for brain imaging have various limitations: 2-(F-18)fluoro-2-deoxyglucose (F-18-FDG) has a very short half-life. The physical properties of di-β-(piperidinoethyl)-(Se-75)selenide (Se-75-PIPSE) and di-β-(morpholinoethyl)-(Se-75)-selenide (Se-75-MOSE) are not ideal. Thallium-201 diethyldithricarbamate (T1-201-DDC) has unfavourable nuclidic characteristics, limited availability, a long half-life and high cost. I-123 in N-isopropyl-p-iodoamphetamine (I-123-IMP) and N,N,N′-trimethyl-N′-(2-hydroxy-3-methyl-5-iodobenzyl)-1,3-propanediamine (I-123-HIPDM) are not freely available and are expensive. N-13-labelled ammonia has a very short half-life. Technetium-99m hexamethylpropyleneamineoxime (Tc-99m-HM-PAO) is unstable both in vitro and in vivo and has a low brain-to-blood ratio. These limitations underline the need for the development of a technetium-99m-containing radiopharmaceutical which would conform to the standards set for brain-imaging agents. This research is continuing and compounds such as the technetium-99m N-piperidinylethyl diaminodithiol (Tc-99m-NEP-DADT), which shows promising brain uptake in animals, have been reported. However, the ideal brain agent has yet to be developed.

20663 (PER—164, pp 11-16) **New Tc-99m =radiopharmaceuticals for cardiac perfusion studies.** Van Wyk, A.J. Aug 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705936/JAW. (CONF-8808197—).

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

Tl-201 suffers from several drawbacks as a cardiac agent, i.e. unsatisfactory nuclidic properties, limited availability, biological redistribution and high cost. Several promising Tc-99m cationic isonitrile compounds have recently been develped to address these problems, viz. TBI, CPI and MIBI. Although showing clear myocardial uptake, Tc-99m-TBI exhibits redistribution as well as high lung and liver uptake with retention. Tc-99m-CPI shows lower lung uptake but relatively high liver uptake and also myocardial washout. Tc-99m-MIBI shows relatively low lung and liver activity and significant myocardial retention to give a good target-to-background ratio. A programme was recently started to make some of these agents available locally. The isonitrile MIBI and its ethyl analogue were synthesized as follows: 2-methylallylamine. HCl was formylated to give N-2-methyl-2-propenylformamide. Selective reduction and hydrolysis in methanol (ethanol) gave N-2-methoxy (ethoxy)-methylpropylformamide. Finally dehydration gave 2-methoxy(ethoxy)-2-methylpropyl isonitrile: MIBI (EMI). Excellent cooperation with the Dept of Biophysis, UOFS, and the Dept of Life Science, UP, was obtained to study these agents both in baboons and patients. After synthesis, labelling procedures were worked out for the tc-99m isonitriles, involving reduction in an autoclave process for 15 - 20 min, followed by dichloromethane extraction, dissolution in 1% Tween 80-saline solution and Millipore filtration to give final yields of 50 - 60%. Radiochemical purity was verified by various chromatographic procedures. Both MIBI and EMI showed rapid biliary clearance in primates, ensuring adequate visualization of the myocardium due to lower liver and lung background after 60 min. In patients studies with MIBI favourable heart-to-lung (liver) ratios were also found. The results indicate that Tc-99m-MIBI compares favourably with Tl-201 and is a promising agent to evaluate myocardial ischemia and infarction.

20664 (PER—164, pp 22-32) **Technetium-99m labelling of monoclonal antibodies for in vivo radioimmunodiagnostic use.** Beyers, M. Aug 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705936/JAW. (CONF-8808197—).

From 3. congress of the SA Society of Nuclear Medicine; Bloemfontein, South Africa (15 Aug 1988).

The strong chelating agent diethylenetriaminepentaacetate (DTPA), either as the bicyclic or as the mixed anhydride, is most commonly used to link Tc-99m to proteinaceous compounds. A method for the batch production of DTPA-labelled antibody kits as well as a novel method of DTPA chelation of unpurified ascites fluid is given. Loss of immunoreactivity and in vivo stability occurs with this method. That DTPA conjugation is not the ideal method of labelling, is borne out by the fact that Hnatowich - a pioneer of DTPA-protein chelating - changed to an avidin-biotin labelling system. Modifications of the carbohydrate moiety have also been attempted. High molecular mass polymers with chelate-linkage to the antibodies can bind up to 150 di- or trivalent ions per mole without a loss in antigen-binding activity. Other than DTPA, several chelating agents such as bisthiosemicarbazones, metallothionein and diamide dimercaptide ligands may be used. The simple treatment of a proteinaceous substance with a disulpide-reducing agent, followed by exposure of the reduced protein to a suitable radionuclide, leads to a promising stable radiolabelled product. A Tc-99m-labelled antibody is, subject to FDA approval, scheduled for released by a Kodak-financed company in the near future.

20665 **(UCRL—100110) Development and characterization of a fiber optic immuno biosensor.** Northrup, M.A.; Stanker, L.H.; Vanderlaan, M.; Watkins, B.E. (Lawrence Livermore National Lab., CA (USA)). 9 Dec 1988. Contract W-7405-ENG-48. 15p. (CONF-8811163—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005062/JAW.

From NATO Advance Study Institute on spectroscopy of inorganic bioactivators; Loutraki, Greece (1 Nov 1988).

In this paper we describe preliminary results from the development and characterization of a fiber optic biosensor that utilizes a fluorescently-labeled monoclonal antibody to pyrethroid pesticides. A synthetic pyrethroid-like antigen was coupled to bovine serum albumin and immobilized on the surface of a stripped portion of the

distal end of an optical fiber. Each fiber was individually calibrated for its optical response using standard solutions of fluoresceinamine. Binding of the antibody was detected via the evanescent wave of the fiber by use of a portable fiber optic fluorimeter. Initial binding rate and equilibrium levels of bound antibody showed a linear relationship with antibody concentrations between 7 nM and 25 uM. To test the reversibility of the biosensor, bound antibody was removed with protein denaturing agents and the same fibers were retested with similar concentrations of antibody. When re-immersed in antibody solution, binding of the antibodies was again observed. The results provide encouraging evidence that such a biosensor may be useful for the determination of small organic molecules in situ. 17 refs., 8 figs.

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REFER ALSO TO CITATION(S) 19176, 19229, 20198

20666 (ANL/PPRNT—89-108) Photoreactivation in Escherichia coli phr-1 mutants. Hrynko, T.A.; Peak, M.J. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008438/JAW.

Photoreactivation (PR) has been observed in E. coli phr-1 mutants by several investigators, contradicting the consensus that these strains are completely PR deficient. Several theories have been advanced regarding the nature of this photorepair, including the possible existence of a second photolyase enzyme. Our studies confirm the finding that PR occurs in phr-1 mutants and in light of recent observations on the nature of the 6-4 photoproduct, support the theory that photolysis of this lesion leads to the increased survival we have witnessed. Results are briefly discussed. 13 refs., 1 fig., 1 tab.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 19479, 19488, 19489, 20141, 20201, 20553, 20554, 20583, 20655, 20727, 20729, 20731, 20733, 20769

20667 (IAEA-AL—004, pp 31-32) **Phytate measurements.** Morris, E.R. (Agricultural Research Service, Beltsville, MD (USA). Beltsville Human Nutrition Research Center). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20668 (IAEA-AL—004, pp 33) **Fiber measurement: State of the art.** Prosky, L. (Food and Drug Administration, Washington, DC (USA)). Oct 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705971/JAW. (CONF-8710451—).

From IAEA-NBS international workshop on practical analytical approaches to the assessment of human dietary intake of nutrients, toxic constituents and radionuclides; Gaithersburg, USA (2 Oct 1987).

20669 (IAEA-R—2991-F) Varietal improvement of Brassica species through introduction, hybridization and mutation breeding techniques. Final report for the period 1 November 1987 - 31 May 1988. Rhaman, A. (Institute of Nuclear Agriculture, Mymensingh (Bangladesh)). (International Atomic Energy Agency, Vienna (Austria)). Nov 1988. 20p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705458/JAW.

Germplasm of Brassica campestris and Brassica juncea was collected from various parts of Bangladesh and evaluated for yield, oil content etc. prior to the breeding programme. Seeds of the B. campestris variety YS-52, possessing good agronomic characteristics, were treated with mutagens (gamma rays and sodium azide) to widen the genetic variation. Mutants were selected for higher yield and resistance against Alternaria brassicae. The two mutant lines BINA 1 and BINA 2 were selected exceeding the parent variety considerably in yield and disease resistance. They are candidates for recommended varieties. Brassica juncea variety RCM 625 was treated with gamma rays and EMS. Four higher yielding and earlier maturing mutants are being evaluated further. 6 tabs.

20670 (INIS-BR—1408) Use of nitrogenous fertilizer (/ sup 15/NH/sub 4/)SO/sub 4/ in a bean culture (Phaseolus vulgaris L.). Urquiaga C, S.; Libardi, P.L.; Reichardt, K.; Matsui, E.; Victoria, R.L. (Universidad Nacional Agraria, Lima (Peru)). (Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil)). 1984. 2p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705519/JAW.

20671 (INIS-BR—1422) Determination of lethal and sterilizing dose of gamma radiation in larvae of Palembus dermestoides (Fairm. 1893) (Col., Tenebrionidae) in peanut. Ribeiro, E.M.C.; Arthur, V. (Escola Superior de Agronomia de Paraguacu Paulista, Sao Paulo, SP (Brazil); Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil)). (Taubate Univ., SP (Brazil). Dept. de Agronomia). 1984. 1p. (In Portuguese). (CONF-8409415—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705745/JAW.

From 4. Brazilian congress on agronomics scientific introduction; Taubate, Brazil (11 Sep 1984).

20672 (INIS-BR—1423) Determination of lethal immediate dose (DL/sub 100/I) for adults of Sitophilus granarius (Linne, 1758) (Col., Curculionidae) by gamma radiation. Ribeiro, E.M.C.; Arthur, V.; Wiendl, F.M. (Escola Superior de Agronomia de Paraguacu Paulista, Sao Paulo, SP (Brazil); Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil)). (Taubate Univ., SP (Brazil). Dept. de Agronomia). 1984. 1p. (In Portuguese). (CONF-8409415—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705746/JAW.

From 4. Brazilian congress on agronomics scientific introduction; Taubate, Brazil (11 Sep 1984).

20673 (INIS-GB—174) Response of the Advisory Committee on Irradiated and Novel Foods (ACINF) to comments received on the "Report on the safety and wholesomeness of irradiated foods" (HMSO -ISBN 0 11 321059 0). (Department of Health and Social Security, London (UK); Ministry of Agriculture, Fisheries and Food, London (UK); Scottish Office, Edinburgh (UK); Ministry of Agriculture, Fisheries and Food, London (UK). Welsh Office; Department of Health and Social Services Northern Ireland, Belfast (UK)). Nov 1987. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705524/JAW.

The Advisory Committee on Irradiated and Novel Foods (ACINF) replies to comments received on the publication of the Report on the Safety and Wholesomeness of Irradiated Foods. Comments were received concerning the assessment of the potential risks of food irradiation versus possible benefits, the effects of irradiation on vitamin levels, the production of free radicals and toxic substances, the likelihood of the irradiation of unfit foods, the effects on food additives and packaging, dose rates and radioactivity levels. The ACINF did not consider any of the fears to be justified or any comments would cause a change in advice given in the report. Recommendations were made. (U.K.).

20674 (INIS-mf—11350, pp 39-78) **High energy units in food and pharmaceutical processing.** Sadat, T. (CGR MeV, 551 rue de la miniere, 78530 BUC, (France)). 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780070/JAW. (CONF-8704366—).

From Seminar on industrial applications of electron beams; Dublin, Ireland (16 Apr 1987).

Linear accelerators for industrial uses and for preservation of food are discussed. The advantages and limits of ionizing technique are outlined and a detailed description of CGR MeV's two industri-

al accelerator lines is provided with a description of the facility, description of treatment parameters and performances also discussed.

20675 (INIS-mf—11350, pp 79-83) **Food irradiation - a Northern Ireland dimension.** McMurray, C.H.; Stevenson, M.H. (Department of Agriculture for Northern Ireland, Belfast (UK)). 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780070/JAW. (CONF-8704366—).

From Seminar on industrial applications of electron beams; Dublin, Ireland (16 Apr 1987).

Irradiation is a technology which has been exploited in a wide variety of industries ranging from sterilization of medical products and polymer modification to applications with respect to food. Whilst food irradiation has recently become a controversial subject, the process has been studied for many years. Many products could be irradiated to advantage and these need to be thoroughly investigated before final recommendations can be made as to the commercial feasibility and suitability of the processing technology in the Northern Ireland context.

20676 (INIS-mf—11356, pp 116) **Effect of ionizing radiation on some physical properties of lactalbumin.** Kispeter, J.; Kiss, L.; Beczner, J.; Borbely-Kiss, I.; Horvath, L.; Rozsa, Z. (Univ. of Horticulture and Food Industry, Faculty of Food Industry, Szeged (Hungary); Central Food Research Institute, Budapest (Hungary); Hungarian Academy of Sciences, Institute of Nuclear Research, Debrecen (Hungary); Hungarian Academy of Sciences, Biological Research Centre, Szeged (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20677 (INIS-mf—11356, pp 90) **Effect of gamma radiation on digestibility of high fiber materials.** Gralak, M.A.; Krasicka, B.; Kulasek, G.; Kamalu, T.; Jaworek, D. (Warsaw Agricultural Univ., Department of Animal Physiology, Warszawa (Poland); Nigeria Univ., Nsukka; Warsaw Agricultural Univ., Department of Food Hygiene, Warszawa (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20678 (INIS-mf—11356, pp 61) **Supraoesophageal ganglion as an indicator of irradiation treatment during quarantine fruit inspection.** Busch-Petersen, E.; Rigney, C.J.; Rahman, R. (International Atomic Energy Agency, Vienna (Austria); Atomic Energy Research Establishment, Ganakbari, Savar, Dhaka (Bangladesh)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20679 (INIS-mf—11356, pp 103) **Radiation biology of the acarid mites (acari: acaridae).** Ignatowicz, S. (Agricultural Univ. of Warszawa, Department of Applied Entomology, Warszawa (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20680 (INIS-mf—11356, pp 177) **Laboratory studies directed towards the development of a genetic sexing technique in the mediterranean fruit fly ceratitis capitata (weid.).** Shahjahan, R.M.; Wood, R.J. (Manchester Univ. (UK)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20681 (INIS-mf—11356, pp 193) **Postirradiation ultrastructural changes in gonial cells and reproductive tract of acarus siro (l.).** Szlendak, E. (Warsaw Agricultural Univ., Dept. of Applied Entomology, Warsaw (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20682 **(INIS-mf—11356) 19th annual meeting of the European society of nuclear methods in agriculture.** (European Society of Nuclear Methods in Agriculture (ESNA)). 1988. 238p. (CONF-8808202—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW.

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

179 abstracts are presented but only 91 of them are in INIS scope and are treated separately. The content is indicated in the headings of the 12 working groups: food irradiation; radiation induced stimulation effects in living organisms; tracer techniques in animal sciences; physical methods; soil-plant relationships; applied mutagenesis; environment pollution; energy in agriculture; genetical methods in pest control; radioisotopes in insect ecology. (qui).

20683 (INIS-mf—11356, pp 69) **Induced resistance and the reutilization of radionuclides from bulbs to developing plants.** Dmitriev, A.; Grodzinsky, D.; Guscha, N. (Ukrainian Academy of Science, Institute of Botany, Kiev (Ukrainian SSR)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20684 (INIS-mf—11356, pp 130) **Recurrant selection for use of micro mutants in breeding programs.** Lazanyi, J. (Research Institute of Debrecen Agricultural Univ., Karcag (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20685 (INIS-mf—11356, pp 149) **Mutants induced in winter rye by fast neutrons.** Muszynski, S.; Darlewska, M. (Warsaw Agricultural Univ., Faculty of Agriculture, Dept. of Plant Breeding and Seed Sciences, Laboratory of Mutagenesis, Warsaw (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20686 (INIS-mf—11356, pp 154) **In vitro mutation breeding techniques for apomictic crops.** Novak, F.J. (Joint FAO/IAEA Programme, Plant Breeding Unit, Seibersdorf Laboratories, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20687 (INIS-mf—11356, pp 197) **Effect of acute and chronic gamma-irradiation on the yield components of five pea species.** Toekei, K.M.; Fueredi, J. (Univ. of Agricultural Sciences, Department of Genetics and Plant Breeding, Goedoelloe (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20688 (INIS-mf—11356, pp 102) **Use of irradiation as a quarantine treatment of agricultural products infested by acarid mites (acari: acaridae).** Ignatowicz, S. (Agricultural Univ. of Warszawa, Department of Applied Entomology, Warszawa (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20689 (INIS-mf—11356, pp 104) **Inherited sterility in the acarid mites (acari: acaridae).** Ignatowicz, S. (Agricultural Univ. of Warszawa, Department of Applied Entomology, Warszawa (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20690 (INIS-mf—11356, pp 110) **Use of nuclear and related techniques in animal disease diagnosis with particular reference to skin infestations.** Jeggo, M.H. (Joint FAO/IAEA Division, Animal Production and Health Section, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20691 (INIS-mf—11356, pp 132) **FAO/IAEA programme in genetic control of insects.** Lindquist, D.A. (FAO/IAEA, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20692 (INIS-mf—11356, pp 36) **Storage experiment with irradiated potatoes.** Alwakdi, O.M.; Szoeke, P.; Pal, I.; Beczner, J. (Univ. of Agricultural Sciences, Goedoelloe (Hungary); Central Food Research Institute, Budapest (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20693 (INIS-mf—11356, pp 48) **Identification of irradiated products by chemiluminescence.** Beczner, J.; Kiss, I. (Central Food Research Institute, Budapest (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20694 (INIS-mf—11356, pp 50) **Status of food irradiation in France.** Boisseau, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Service de Radio-Agronomie). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20695 (INIS-mf—11356, pp 51) **Electron spin resonance identification of irradiated strawberries.** Boisseau, P.; Raffi, J.; Agnel, J.P.; Buscarlet, L. (CEA Centre d'Etudes Nucleaires de Cadarache, Secteur de Radiobiologie des Substances Naturelles, Saint-Paul-lez-Durance (France)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20696 (INIS-mf—11356, pp 57) **Radiation disinfestation of food products infested by the acarid mites (acari: acaridae).** Brzostek, G.; Ignatowicz, S. (Agricultural Univ. of Warszaw, Dept. of Applied Entomology, Warszaw (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20697 (INIS-mf—11356, pp 58) **Irradiation as a quarantine treatment for beans infested by the bean weevil, acanthoscelides obtectus say (col., bruchidae).** Brzostek, G. (Agricultural Univ. of Warszaw, Dept. of Applied Entomology, Warszaw (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20698 (INIS-mf—11356, pp 70) **Supplement to investigation of technologic processes of caesium 134, 137 decontamination of beef and lamb meat.** Draganovic, B.; Micic, G. (Veterinary Faculty, Department of Radiology and Radiation Hygiene, Beograd (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20699 (INIS-mf—11356, pp 78) **Further experiments on the detection of irradiation of dry food ingredients based on starch degradation.** Farkas, J.; Sharif, M.M.; Koncz, A. (Univ. of Horticulture and Food Industry, Institute of Food Technology, Budapest (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20700 (INIS-mf—11356, pp 85) **Effects of irradiation in relation to terms of application and storage conditions on marketability of onions after long term storage.** Gajewski, M. (Horticultural Research and Development Centre, Warszawa (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20701 (INIS-mf—11356, pp 86) **Market tests with irradiated onions in Poland in 1984 - 1988.** Gajewski, M. (Horticultural Research and Development Centre, Warszawa (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20702 (INIS-mf—11356, pp 94) **Identification of irradiated spices and condiments with luminescence measurements. A European intercomparison.** Heide, L.; Boegl, K.W. (Federal Health Office, Institute for Radiation Hygiene, Neuherberg (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20703 (INIS-mf—11356, pp 108) **Some investigations of γ-irradiated whole egg powder.** Jantz, A.; Funke, D. (Bezirkshygieneinspektion und -Institut, Insp. Lebensmittel- und Ernaehrungshygiene, Schwerin (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20704 (INIS-mf—11356, pp 118) **Properties of irradiated egg-white.** Kiss, I.; Hajos, G.; Halaasz, A. (Central Food Research Institute, Budapest (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20705 (INIS-mf—11356, pp 120) **Identification of irradiated fresh fruits.** Kovacs, E.; Keresztes, A. (Central Food Research Institute, Budapest (Hungary); Eoetvoes Lorand Univ., Department of Plant Anatomy, Budapest (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20706 (INIS-mf—11356, pp 125) **Canadian perspectives on food irradiation.** Kunstadt, P. (AECL Radiochemical Company (Canada)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20707 (INIS-mf—11356, pp 127) **Effect of heat, irradiation, packaging and their combination on the keeping quality of tomatoes artificially infected with Botrytis Cinerea.** Langerak, D.I.; El-Buzedi, M.; Wolters, T.C.; Goa, D. (State Institute for Quality Control of Agricultural Products, Wageningen (Netherlands)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20708 (INIS-mf—11356, pp 128) **Food irradiation progress in Israel 1987/1988 and programme for 1989.** Lapidot, M.; Saveanu, S. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20709 (INIS-mf—11356, pp 133) **Worldwide status of food irradiation and the FAO/IAEA/WHO/ITC-UNCTAD/GATT international conference on the acceptance. Control of and trade in irradiated food.** Loaharanu, P. (Joint FAO/IAEA Division, Food Preservation Section, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20710 (INIS-mf—11356, pp 178) **Role of linear accelerators in the United States food irradiation programs.** Sivinski, J.S. (Radiation Technology Programs, Albuquerque (USA)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20711 (INIS-mf—11356, pp 179) **Status of food irradiation programs and regulations in the United States.** Sivinski, J.S. (Radiation Technology Programs, Albuquerque (USA)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20712 (INIS-mf—11356, pp 192) **Effect of irradiation on antibacterial efficacy of sodium nitrite in cured meat.** Szczawinski, J.; Szulc, M. (Warsaw Agricultural Univ., Faculty of Veterinary Science, Dept. of Food Hygiene, Warsaw (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20713 (INIS-mf—11356, pp 203) **Removing of salmonella contamination in fish flour by means of ionizing radiation.** Vacek, K.; Rejholec, J. (Nuclear Research Institute, Rez (Czechoslovakia); State Veterinary Institute, Terezin (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20714 (INIS-mf—11356, pp 210) **Binding of methylene blue by natural actomyosin gel irradiated with 16 kGy.** Zabielski, J.; Uchman, W. (Univ. of Agriculture of Poznan, Poznan (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20715 (INIS-mf—11356, pp 211) **Effect of gamma irradiation on functional properties of broiler meat.** Zabielski, J.; Fiszer, W. (Univ. of Agriculture of Poznan, Poznan (Poland)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20716 (INIS-mf—11356, pp 68) **Radioimmunoassay of milk progesterone in cows as an aid in the evaluation of ovarian activity in the post partum period and in early pregnancy diagnosis.** Djurdjevic, D.; Zeremski, M. (Univ. of Belgrade, Veterinary Faculty, Belgrade (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20717 (INIS-mf—11356, pp 91) **Radioimmunoassay kits for diagnosis of herpesvirus infections of cattle and swine.** Hampl, J.; Rodak, L.; Smid, B.; Pospisil, Z.; Jurak, E.; Skrobak, F. (Veterinary Research Institute, Brno (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20718 (INIS-mf—11356, pp 129) **Low cost small scale commercial food irradiation facility.** Lapidot, M.; Saveanu, S. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20719 (INIS-mf—11356, pp 75) **Soil science research activities in joint FAO/IAEA programmes.** Eskew, D.L.; Bowen, G.D.; Zapata, F. (Joint FAO/IAEA Division, Soil Fertility, Irrigation and Crop Production Section; International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20720 (INIS-mf—11356, pp 174) **Past, present and future tasks of the joint FAO/IAEA division.** Sigurbjoernsson, B. (Joint FAO/IAEA Division, IAEA, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20721 (INIS-mf—11356, pp 206) **Critical evaluation of tracer uptake experiments using /sup 36/ClO/sub 3/ as nitrate analog.** Wieneke, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 19487

20722 **(ANL/PPRNT—89-153) Effect of low dose rate irradiations with fission-spectrum neutrons on mutation induction of Chinese hamster cells and human diploid fibroblasts.** Kubota, Nobuo; Jones, C.A.; Hill, C.K. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008452/JAW.

Cell survival and induction of the forward mutation leading to 6-thioguanine resistance were measured in Chinese hamster V79 cells and human diploid lung fibroblast 1MR-91 cells exposed to fission-spectrum neutrons (from the JANUS reactor at the Argonne National Laboratory) delivered at both high and reduced dose rates. Exponentially growing cells were irradiated at 10.3 or 20.6 cGy/min for high dose rate and at 0.43 cGy/min for reduced dose rate. Both cell lines exposed to neutrons showed little or no significant differences in cell killing between acute and protracted doses. On the other hand, mutation induction of V79 cells after low dose rate exposures to fission-spectrum neutrons, given at 0.43 cGy/min, was significantly enhanced at doses above 100 cGy as compared to that after high dose rate exposures. Protracted irradiation of IMR-91 cells with neutrons also resulted in enhancement of the mutation frequency in the dose region of up to 75 cGy. These results are discussed in terms of cell cycle dependency for mutation induction and error-prone repair of mutational damage after protracted irradiations with fission-spectrum neutrons. 33 refs., 5 figs.

20723 **(CONF-8807157—1) Tissue responses to low protracted doses of high let radiations or photons: Early and late damage relevant to radio-protective countermeasures.** Ainsworth, E.J.; Afzal, S.M.J.; Crouse, D.A.; Hanson, W.R.; Fry, R.J.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;W-31109-ENG-38;AC03-76SF00098. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007527/JAW.

From Committee on Space Research workshop; Espoo, Finland (18 Jul 1988).

Early and late murine tissue responses to single or fractionated low doses of heavy charged particles, fission-spectrum neutrons or gamma rays are considered. Damage to the hematopoietic system is emphasized, but results on acute lethality, host response to challenge with transplanted leukemia cells and life-shortening are presented. Low dose rates per fraction were used in some neutron experiments. Split-dose lethality studies (LD 50/30) with fission neutrons indicated greater accumulation of injury during a 9 fraction course (over 17 days) than was the case for γ-radiation. When total doses of 96 or 247 cGy of neutrons or γ rays were given as a single dose or in 9 fractions, a significant sparing effect on femur CFU-S depression was observed for both radiation qualities during the first 11 days, but there was not an earlier return to normal with dose fractionation. During the 9 fraction sequence, a significant sparing effect of low dose rate on CFU-S depression was observed in both neutron and γ-irradiated mice. CFU-S content at the end of the fractionation sequence did not correlate with measured LD 50/30. Sustained depression of femur and spleen CFU-S and a significant thrombocytopenia were observed when a total neutron dose of 240 cGy was given in 72 fractions over 24 weeks at low dose rates. The temporal aspects of CFU-S repopulation were different after a single versus fractionated neutron doses. The sustained reduction in the size of the CFU-S population was accompanied by an increase in the fraction in DNA synthesis. The proliferation characteristics and effects of age were different for radial CFU-S population closely associated with bone, compared with the axial population that can be readily aspirated from the femur. In aged irradiated animals, the CFU-S proliferation/redistribution response to typhoid vaccine showed both an age and radiation effect. 63 refs., 6 figs., 7 tabs.

20724 **(CONF-8810248—2) Central nervous system tumors and related intracranial pathologies in radium dial workers.** Stebbings, J.H.; Semkiw, W. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007376/JAW.

From NCI-DOE-CEC workshop on risks from radium and thorium; Bethesda, MD, USA (3 Oct 1988).

Among the female radiation workers in the radium dial industry there is no overall excess of brain or central nervous system tumors. A significant excess did appear, however, in one of three major cohorts; the excess was not due to an excess of gliomas and cannot be ascribed with certainty to radium or external radiation. A significant proportional excess of tumors outside the brain was observed, and is consistent with irradiation of nervous system tissue from adjacent bone. Early deaths from brain abscess or mastoiditis, which are coded as diseases of the nervous system and sense organs, were observed. 12 refs., 11 tabs.

20725 **(GSI—88-67-Prepr.) Radiobiological and physical basis for radiotherapy with protons and heavier ions.** Kraft, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Nov 1988. 13p. (CONF-8810326—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757125/JAW.

From International workshop on particle therapy; Essen, F.R. Germany (28 Oct 1988).

Heavy charged particles exhibit a superior dose distribution compared to all conventionally used beams. The small lateral and range straggling, combined with an increase of the dose deposition with increasing penetration depth enables the production of dose profiles shaped precisely to the contours of the treatment volume. In addition, heavy ion beams exhibit an elevated biological efficiency close to the end of the particle range. Therefore, beams of heavy ions deliver a high physical dose combined with a high biological efficiency to a tumor volume while the surrounding healthy tissue is maximally spared.

20726 **(IFIN-RB—25-1988) Cs-134 and Cs-137 in human body.** Dumitru, C.; Ionescu, C.; Iosif, S. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Jan 1988. 6p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706048/JAW.

Cs-134 and Cs-137 in the human body after the Chernobyl nuclear accident, was measured since July 1986 till December 1987 for 1461 adults(851 males and 610 females) living in Bucharest area using the Whole Body Counter type SGCU-S. The equipment, the calibration procedure and experimental results are described. (authors).

20727 (INIS-BR—1411, pp 314-330) **Results of strontium-90 measurements in various media in the Federal Republic of Germany after the Chernobyl accident.** Winter, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The working Group on Environmental Monitoring of the Fachverband fuer Strahlenschutz e.V. (Professional Association for Radiation Protection) performed an inquiry, after the Chernobyl reactor accident, into the results of strontium-90 mesurements carried out for the territories of the Federal Republic of Germany and Switzerland. The results of measurements of approx. 1000 samples prove Sr-90 contamination of the environmental media, including food, as a result of Chernobyl fallout to have been low in the Federal Republic of Germany and in Switzerland, compared with the contamination due to the I-131 and Cs-137 nuclides. The same applies to the amount of Sr-90 transferred into the soil as compared with the level of contamination due to nuclear weapons fallout accumulated since the 60s.

20728 (INIS-mf—11350, pp 84-90) **Radiological safety - a brief outline of the regulatory position in Ireland.** Nowlan, N.V. (Nuclear Energy Board, Dublin (Ireland)). 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780070/JAW. (CONF-8704366—).

From Seminar on industrial applications of electron beams; Dublin, Ireland (16 Apr 1987).

The EEC directives on radiation safety have not yet been adopted by Ireland and the Board through its own licensing procedures has been the only body responsible for enforcing the conditions laid down in the 1980 EEC directives as well as the basic principles of radiation protection recommended by the ICRP. The individual's position with regard to regulatory procedures in the setting up of an electron beam unit is outlined.

20729 (INIS-mf—11356, pp 77) **Combined effect of ionizing radiation plus heat treatment on spores of clostridium sporogenes in canned luncheon meat.** Farkas, J.; Andrassy, E. (Univ. of Horticulture and Food Industry, Institute of Food Technology, Budapest (Hungary)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20730 (INIS-mf—11356, pp 131) **Response of peroxidase and amylase isoenzyme activities of Aesculus hippocastanum and Picea abies to gamma and beta irradiation.** Lickl, E.; Beck, R.H.F.; Ebermann, R. (Ludwig Boltzmann-Institut fuer Klinische Onkologie, Vienna (Austria); Univ. fuer Bodenkultur, Institut fuer Chemie, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20731 (INIS-mf—11356, pp 39) **Influence of the low doses gamma-rays on the pigs immune reactivity.** Arsov, R.; Todorov, B.; Ivanov, P.; Ivanov, I.; Tzachev, I. (Higher Institute of Veterinary Medicine, Stara Zagora (Bulgaria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20732 (INIS-mf—11356, pp 175) **Effects of gamma radiation on tibia fracture healing in dog after rigid plate fixation.** Simpraga, M. (Univ. of Zagreb, Veterinary Faculty, Dept. of Physiology and Radiobiology, Zagreb (Yugoslavia)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20733 (INIS-mf—11356, pp 184) **Lysozyme and complement activity at the irradiated with low-doses gamma-rays pigs.** Sotirov, L.; Arsov, R.; Todorov, B.; Tzachev, I. (Higher Institute of Veterinary Medicine, Stara Zagora (Bulgaria)). 1988. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705770/JAW. (CONF-8808202—).

From 19. annual meeting of the European Society of Nuclear Methods in Agriculture; Vienna, Austria (29 Aug 1988).

20734 (KFK—4194) **Interpretation of individual exposures in mixed beta-photon radiation fields at the production of fuel elements of low-enriched uranium for light water reactors.** Piesch, E.; Burgkhardt, B.; Anton, R.; Rudolph, W.; Schaefer, R.; Gueldner, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.). Abt. Nukleare Sicherheit; Reaktor-Brennelement Union, Hanau (Germany, F.R.). Hauptabteilung Keramik). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Dec 1988. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757149/JAW.

The radiation fields at work places have been investigated using thermoluminescence dosemeters in order to find an exact relationship between the indicated dose contributions for partial or whole body exposure and the relevant annual dose limits as well as to check the dosemeter locations with respect to the required representativity for partial and whole body exposures. The investigations have shown that the present weighting procedure for the beta dose contribution overestimates the whole body dose because the contribution affects only the partial body dose of the skin. As a future procedure it is proposed to evaluate the photon dose contribution as the whole body exposure and the beta dose contribution as a partial body exposure of the skin. According to the Radiation Protection Ordinance and the ICRP 26, respectively, the partial body exposure of the skin can not be added to the whole body exposure or the effective dose equivalent. The experiments in addition showed that in the actual mixed beta-photon radiation field the location of the dosemeter in the height of the breast was found to be representative for the estimation of the whole body exposure as well as of partial body exposures of the lens of the eye and the gonades. The estimation of partial body exposure of the hands showed that the expected dose results are below 3/10 of the dose limits.

20735 (KFK—4444) **Radiological protection: A topical and a continual task.** Urban, M.; Koelzer, W. (comps.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Sep 1988. 167p. (In German). (CONF-8806335—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW.

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

This colloquium has been organized by the KfK on the occasion of the retirement of the head of the Safety Department (Hauptabteilung Sicherheit) of Karlsruhe Nuclear Research Center. Individual subject analyses of seven of the papers presented are available in the database.

20736 (KFK—4444, pp 95-113) **Current radiological protection issues in the UK.** Clarke, R.H. (National Radiological Protection Board, Chilton (UK)). Sep 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

The recent re-evaluations of the risks of radiation from the revised Japanese dosimetry have led to recommendations in the UK for new controls on exposures to workers and members of the public. The reasons behind these recommendations by NRPB is explained. Much of the concern over exposures of members of the public in the United Kingdom relates to the alleged high incidence of childhood leukaemia around operating nuclear plants. This issue is described and the work of the Board in investigating the possible link with environmental radiation is outlined. Finally, the Board has just published its analysis of the possible health effects of veterans of the UK atmospheric nuclear weapons tests in the 1950s and 1960s. The outcome of this study is presented with an analysis of the results.

20737 (KFK—4444, pp 117-126) **Molecular basis of radiation action.** Dertinger, H. Sep 1988. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

During evolution, the living cell has developed highly efficient mechanisms to cope with the consequences of radiation or drug induced genetic damage. Among these passive and active processes are redundancy and biological organization of genetic information (chromosomes or non-coding DNA regions), scavengers of free radicals, enzymatic repair of DNA, and intercellular communication. In addition, radio-resistivity of cells depends on their degree of differentiation. According to recent findings, radiation may also interfere with cellular differentiation via the membrane signal-transduction pathway.

20738 (KFK—4444, pp 143-150) **Medical radiation protection considered from the point of view of the mutual indemnity associations.** Renz, K. (Berufsgenossenschaft der Feinmechanik und Elektrotechnik, Koeln (Germany, F.R.). Inst. fuer Strahlenschutz). Sep 1988. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757151/JAW. (CONF-8806335—).

From Colloquium on radiological protection: A topical and continual task; Karlsruhe, F.R. Germany (23 Jun 1988).

The author discusses the cooperative activities and tasks of the mutual indemnity associations and the KfK with respect to medical radiation protection of the personnel and the corresponding means and measures. He explains the concept developed for providing the required medical and scientific emergency management. The two cases discussed as a practical example deal with the incorporation scanning campaign carried out with the personnel of German firms in the USSR after the Chernobyl reactor accident, and with the problems involved in acknowledgment of radiation injury as an occupational disease.

20739 **(KFK—4475) UFOING: A program for assessing the off-site consequences from ingestion of accidentally released radionuclides.** Steinhauer, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit). Dec 1988. 129p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757153/JAW.

The program UFOING estimates foodchain-related consequences following accidental releases of radionuclides to the atmosphere. It was developed as a stand-alone supplement to the accident consequence assessment program system UFOMOD to allow faster and more detailed investigations of the consequences arising from the foodchain pathways than possible with the version of UFOING which is implemented in UFOMOD. For assumed releases at different times of the year, age dependent individual doses, collective doses, individual risks for fatal stochastic somatic health effects as a function of time, the total numbers of the effects, and the areas affected by foodbans together with the estimated duration of the bans are calculated. In addition, percentage contributions of radionuclides and foodstuffs to the doses and risks can be evaluated. In the first part of this report, an overview over the program is given. The other parts contain a user's guide, a program guide, and descriptions of the data employed and of the version of UFOING which is implemented in UFOMOD.

20740 **(N—89-14210) Solar-flare shielding with Regolith at a lunar-base site.** Nealy, J.E.; Wilson, J.W.; Townsend, L.W. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Dec 1988. 21p. (NASA-TP—2869; L—16488; NAS—1.60:2869). NTIS, PC A03/MF A01.

The Langley high energy nucleon transport computer code BRYNTRN is used to predict time-integrated radiation dose levels at the lunar surface due to high proton flux from solar flares. The study addresses the shielding requirements for candidate lunar habitat configurations necessary to protect crew members from these large and unpredictable radiation fluxes. Three solar proton events have been analyzed, and variations in radiation intensity in a shield medium due to the various primary particle energy distributions are predicted. Radiation dose predictions are made for various slab thicknesses of a lunar soil model. Results are also presented in the form of dose patterns within specific habitat configurations shielded with lunar material.

20741 **(N—89-15070) Preliminary estimates of galactic cosmic ray shielding requirements for manned interplanetary missions.** Townsend, L.W.; Wilson, J.W.; Nealy, J.E. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1988. 22p. (NASA-TM—101516; NAS—1.15:101516). NTIS, PC A03/MF A01.

Estimates of radiation risk to the blood forming organs from galactic cosmic rays are presented for manned interplanetary missions. The calculations use the Naval Research Laboratory cosmic ray spectrum model as input into the Langley Research Center galactic cosmic ray transport code. This transport code, which transports both heavy ions and nucleons, can be used with any number of layers of target material, consisting of up to five different constituents per layer. Calculated galactic cosmic ray doses and dose equivalents behind various thicknesses of aluminum and water shielding are presented for solar maximum and solar minimum periods. Estimates of risk to the blood forming organs are made using 5 cm depth dose/dose equivalent values for water. These results indicate that at least 5 g/sq cm (5 cm) of water of 6.5 g/sq cm (2.4 cm) of aluminum shield is required to reduce annual exposure below the current recommended limit of 50 rem. Because of the large uncertainties in fragmentation parameters, and the input cosmic ray spectrum, these exposure estimates may be uncertain by as much as 70 percent. Therefore, more detailed analyses with improved inputs could indicate the need for additional shielding.

20742 **(NU-DP—85) Spatial analysis of acute lymphoblastic leukaemia in Tyne and Wear. Discussion paper no. 85.** Raybould, S. (Newcastle upon Tyne Univ. (UK)). Nov 1987. 27p. Newcastle upon Tyne Univ., price Pound 2.50.

There has been much debate about the existence and implications of 'clusters' and 'excesses' of several malignancies, particularly relating to Leukaemia in children. This debate is not a new phenomenon, but has occurred over several decades. Unfortunately, little has been achieved, in terms of conclusions reached, perhaps largely because the techniques that have been used are not well understood, and have had little critical evaluation. This paper is an attempt both to further the debate relating to the existence of clusters and excesses, and to evaluate and develop some of the techniques used in that debate.

20743 **(UCRL—15990) The effects of acute radiation on reproductive success of the polychaete worm Neanthes arenaceodentata.** Harrison, F.L.; Anderson, S.L. (Lawrence Livermore National Lab., CA (USA)). [1989]. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008093/JAW.

Laboratory populations of the polychaete worm Neanthes arenaceodentata were exposed to acute doses of external gamma radiation to determine effects on reproduction. Groups of mated pairs received either no radiation (controls) or 0.5, 1.0, 2.0, 5.0, 10, or 50 Gy. The doses were delivered at the time when oocytes were visible in the females and at a rate of 5 Gy/min. The broods from the mated pairs were sacrificed before hatching occurred, and information was obtained on brood size, on the number of normal and abnormal embryos, and on the number of embryos that were living, dying, and dead. The mean numbers of embryos in the broods from the mated pairs exposed to radiation were not significantly different from the mean number from control mated pairs, except for the groups receiving 10 or 50 Gy. However, there was a significant reduction in the percentage of live embryos in the broods from mated pairs that received doses as low as 0. 5 Gy. Also, increased percentages of abnormal embryos were found for the mated pairs exposed to 2.0, 5.0, 10, or 50 Gy. From data on estimated hatch size and actual hatch size, we determined that groups receiving doses as low as 0.5 Gy were significantly different from controls. An important effect of acute irradiation on mated pairs of N. arenaceodentata was increased mortality of the embryos. Except for those mated pairs that received 10 or 50 Gy, there was no evidence for gamete loss or for reduced fertilization success; the number of embryos in the brood did not decrease with increased dose. The results on embryo abnormality and mortality indicate that lethal mutations were most likely induced in the germ cells and that these affected survival of the early life stages. 28 refs., 8 figs., 15 tabs.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 19543

20744 **(DPST—88-651) L-Lake water quality: L-Lake/ Steel Creek Biological Monitoring Program, November 1985--December 1987.** Starkel, W.M.; Chimney, M.J.; Nagle, J.H. (Savannah River Lab., Aiken, SC (USA); Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Mar 1988. Contract AC09-76SR00001. 341p. (ECS-SR—67). NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007934/JAW.

The objectives of this portion of the L-Lake Biological Monitoring Program are to document the physical and chemical characteristics of the developing L-Lake ecosystem, evaluate the effect of reactor operation upon water quality, and identify physical and chemical relationships that may be useful in interpreting the biotic conditions observed. The data presented in this report cover the period from November 1985 through December 1987. Thermal discharges from L-Reactor could induce stratification during winter, but thermal stratification during spring and summer was mainly due to climate. Relatively unstable thermal conditions in summer 1987 were caused by discharge of bottom water through the dam. Summer stratification had a profound effect on water quality. In the hypolimnion dissolved oxygen became depleted, the oxidation-reduction potential became negative, and pH and the concentrations of nitrate and sulfate were lowered.

5603 Chemicals Metabolism And Toxicology

20745 **(CONF-8407202—) 2. report 'Forest decline/air pollutants'.** (Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie, Schmallenberg (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). 1984. 164p. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

This report deals with the effects of air pollutants as ozone and sulfur dioxide on forests with special regard to physiology and histology of conifers and beech trees and of soil chemistry. Separate abstracts were prepared for 13 papers in this report.

20746 (CONF-8407202—, pp 1-34) **Air pollutants as charging factors of terrestrial ecosystems and ways to diminish their damaging effects.** Fabig, W. (Fraunhofer-Institut fuer Toxikologie und Aerosolforschung, Schmallenberg-Grafschaft (Germany, F.R.)). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

On two forest stands (FRG), differing in altitude and degree of forest decline, deposition of air pollutants are measured. These data are compared with chemical, zoological and botanical soil data. Up to now, only the data of soil chemistry and of microbial populations are available. These values are briefly described.

20747 (CONF-8407202—, pp 1-3) **Air pollutants as charging factors of terrestrial ecosystems and ways to diminish their damaging effects. Pt. B.** Krieter. (Mainz Univ. (Germany, F.R.). Geographisches Inst.). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

On 6 different forest stands liming experiments were carried through. New developed fertilizer pellets, containing 70% CaCO/ sub 3/ and 30% MgCO/sub 3/ were tested. Up to now there are no results available.

20748 (CONF-8407202—, pp 1-13) **Investigations on the change of genetic structure of forest tree populations due to acid rain.** Scholz, F. (Bundesforschungsanstalt fuer Forst- und Holzwirtschaft, Grosshansdorf (Germany, F.R.). Inst. fuer Forstgenetik und Forstpflanzenzuechtung). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

The effect of acid rain, respectively the calcium/aluminium ratio, on the genetic structure of Norway spruce (Picea abies (L.) Karst.) seedlings is tested. In laboratory experiments cloned seedlings as well as seedling collectives were treated with solutions, differing in calcium:aluminium ratio. Up to now, there are no results available.

20749 (CONF-8407202—, pp 1-8) **Selective effects of air pollutants on Norway spruce.** Bergmann, F. (Goettingen Univ. (Germany, F.R.). Abt. Forstgenetik und Forstpflanzenzuechtung). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

The effect of air pollutants, in this study ozone and sulfur dioxide, on the genetic structure of Norway spruce (Picea abies (L.) Karst.) seedlings is tested. In laboratory experiments Norway spruce seedlings were fumigated with ozone and sulfur dioxide. The genes of plants with a different degree of damage were analysed. The results are described briefly.

20750 (CONF-8407202—, pp 1-5) **Investigations on the effects of air pollutants on the genetic structure of beech tree populations (Fagus sylvatica). Pre-project: Finding and testing of methods.** Mueller-Starck, G.; Hattemer, H.H. (Goettingen Univ. (Germany, F.R.). Abt. Forstgenetik und Forstpflanzenzuechtung). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

To make investigations on genetic-ecological effects of air pollutants on beech tree populations feasible, it is first of all necessary to carry out a genetic mapping. Here it is described which methods are available for this purpose.

20751 (CONF-8407202—, pp 1-12) **Air pollution monitoring in a selected forest area.** Priebe, A.; Jockel, W. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.)). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

Air pollution monitoring was carried through in a selected forest area. Place, measuring instruments and measuring methods are described. Up to now only few results are available.

20752 (CONF-8407202—, pp 1-17) **Disease resistance and competition behaviour of soil vegetation in forest ecosystems influenced by acid deposition.** Steubing. (Giessen Univ. (Germany, F.R.). Inst. fuer Pflanzenoekologie). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

On two forest stands disease resistance and competition behaviour of the soil vegetation was investigated. For this purpose small fumigation chambers have been installed, to feed higher SO/

sub 2/ concentrations. After one year, no significant effect of fumigation could be found.

20753 (CONF-8407202—, pp 1-8) **Phytotoxic effects of acid and metal on plant roots.** Hecht-Buchholz, C. (Technische Univ. Berlin (Germany, F.R.). Inst. fuer Pflanzenernaehrung). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

Laboratory experiments were carried through, to investigate the effects of aluminium and pH on the root system of conifers. Spruces and pines were grown up with nutrient solutions of different concentrations and compounds of nitrogen and aluminium. Root development, morphology and anatomy were determined, using microscopical methods too. It could be shown that aluminium has a more depressing effect on spruces than on pines.

20754 (CONF-8407202—, pp 1-5) **Registration of reactive atmospheric elements and compounds located nearby endangered forest stands due to 'forest decline'.** Klockow. (Dortmund Univ. (Germany, F.R.). Fachbereich Chemie). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

A research program, measuring air pollutants, is introduced. The measuring values of nitrogen oxides, sulfur oxides, calcium, magnesium, potassium, aluminium, lead and others will be correlated with the state of health of nearby located forest stands.

20755 (CONF-8407202—, pp 1-4) **Characterization of forest trees, affected by air pollutants, by means of plant physiology.** Wild. 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

A reasarch program, dealing with effects of air pollution on forest trees, is introduced. Special regard will be put on physiological aspects as water household and photosynthesis in plants.

20756 (CONF-8407202—, pp 1-19) **Comparative investigations on conifers and beech trees of damaged forest stands and growth chamber experiments to prove the causes of forest decline.** Guderian, R.; Vogels, K. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Inst. fuer Angewandte Botanik). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

A research progam will be carried through to test the effects of air pollutants as ozone and sulfur dioxide on conifers and beech trees. With the help of defined ozone and sulfur dioxide fumigation in growth chambers symptoms, physiology, histology and growth development of forest trees shall be studied.

20757 (CONF-8407202—, pp 1-7) **Multifactorial effects of air pollutants on agricultural plants.** Jaeger, H.J. (Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany, F.R.). Inst. fuer Produktions- und Oekotoxikologie). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

A research program shall be carried through to test the effects of sulfur dioxide and metals on agricultural grass lands and on Lolium, Festuca, Hordeum, Zea mays and Solanum tuberosum. As parameters element contents and biochemical-ecophysiological criteria like enzymatic activity and buffering capacity will be measured.

20758 (CONF-8407202—, pp 1-2) **Effects of phytotoxic substances of leaf organs of Norway spruce and beech tree as factor of forest decline.** Schuett. (Muenchen Univ. (Germany, F.R.). Lehrstuhl fuer Forstbotanik). 1984. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770272/JAW.

From 3. status seminar of the R and D programme 'Acid precipitations as a burden on terrestrial ecosystems, and methods to reduce their harmful effects'; Schmallenberg, F.R. Germany (5 Jul 1984).

A research program shall be carried through to investigate the effects of substances, originating from leaves of damaged trees, on plants as Vaccinium and Rubus. Substances as abscisic acid and others will be tested by biological tests.

20759 **(CONF-8804150—3) Summary: Toward better risk assessment and risk management for toxics.** Russell, M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007525/JAW.

From Symposium on assessing the risks from toxics in the northern California environment: what science can tell us; San Francisco, CA, USA (7 Apr 1988).

This paper is a revision of the transcript of remarks delivered at the closing session of the Symposium "Assessing the Risks from Toxics in the Northern California Environment: What Can Science Tell Us?" From the papers and the Symposium discussion I draw three themes. The "toxics" in the environment will be dealt with badly unless their diversity is recognized. Rhetoric about following the guidelines wherein risk assessment, risk management, and risk communication are conducted is often honored only in the breech, even by those who support the guidelines in principle. A central question is how to deal with trade-offs; not only is this technically difficult, but it also raises deeper issues of man in society.

20760 **(GSF—13/87) Concept for early detection and judgement of environmental changes with the recommendations of the Project Council Early Detection of Damage to Environment and Health.** Schmidt-Bleek, F.; Peichl, L.; Behling, G.; Mueller, K.W.; Buesing, J.; Hamann, H.J.; Reiml, D.; Ritzl, I. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Projektgruppe Frueherkennung von Umwelt- und Gesundheitsschaeden (PFU)). Mar 1987. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757160/JAW.

In 1985, GSF (Gesellschaft fuer Strahlen- und Umweltforschung) started the project 'Early Detection of Damage to Environment and Health'. The aim was to develop a concept for improving early detection and judgement of changes in the environment permitting scientific measures for their evaluation to be instituted sooner than hitherto and to provide a sounder basis for decisions. With substantial support given by the Project Council Early Detection at GSF, a broad range of possible approaches was analysed and first practical investigations were brought under way to study their chances of realization more closely. The following fields of work were identified for promoting the early detection and judgement of changes in the environment - the necessary scientific studies exceed the scope of GSF; other large scientific institutions in particular could make valuable contributions - : Data acquisition and preparation; preparation of environmental data collected routinely; recording and analysis of hints from individual persons; collecting and preparation of data on chemicals; integration and preparation of human health data; development and use of key indicators; stimulation and implementation of studies of problem areas.

20761 **(NP—9770267) Post-mortal changes in blood Cd levels in consideration of Cd levels in organs.** Goetz, D. (Freie Univ. Berlin (Germany, F.R.)). 4 Sep 1987. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770267/JAW.

After a detailed introduction, in which the properties and occurrence of Cd, the Cd metabolism and the Cd concentration in blood and organs, and the effects of smoking are discussed, the author presents the results of Cd concentration measurements in the biological materials of a collective of patients who died in the intensive care unit of an internal ward. In all cases, the postmortal Cd concentration in venal blood was much higher than the in-vivo concentration. The concentration increase is not noticeable in the first two hours post mortem; from the forensic view, it is therefore recommended to sample blood as early as possible in case of suspected Cd poisoning. After a latency period of 38 to 92 h, intracardial blood Cd concentrations will be high enough to suspect Cd intoxication, or at least a very high Cd exposure. This tentative diagnosis of Cd intoxication can be proved or disproved only by the rather tedions measurement of Cd concentrations in organs. Postmortal toxicological blood screening should, therefore, not lead to hasty conclusions. The contribution of smoking to Cd concentrations was clearly proved by comparisons of blood Cd concentrations and organ Cd concentrations of smokers and nonsmokers.

20762 **(NP—9770269) Metabolism and toxicity of the heavy metals Cd, Pb, and Zn during the development of a holometabolic insect. Studies on laboratory cultures of fruit flies (Drosophila melanogaster Meig.).** Backhaus, B. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 29 Jun 1987. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770269/JAW.

The metabolism and effects of Cd, Pb, and Zn, given either individually or combined during the different stages of larval development of a holometabolic insect (Drosophila melanogaster) were investigated. The sensitivity of larvae to individual doses of Cd, Pb, and Zn in common ambient-air doses was low. The threshold concentrations in the broth were above the limiting values for culture soil set forth in 1980 by UBA. In case of combined administration, Cd and Pb have a synergetic effect with regard to delayed development prior to metamorphosis, so that developmental disturbances are found already at concentrations that are 50% lower. Antagonistic effects of zinc on the Cd-induced growth disturbances are only detected at relatively high Cd concentrations. Heavy metal exposure during larval development causes increased mortality also during metamorphosis. After hatching, Cd resorption is higher by 33% in males than in females, but only females are lethally damaged. No sex-specific differences were established for Zn and Pb. (ECB).

20763 **(NP—9770276) Investigations in the carcinogenicity of diesel-engine exhaust-gas condensate and with subfractions implanted into the lungs of rats.** Deutsch-Wenzel, R.; Brune, H. (Biologisches Lab. Dr. med. H. Brune, Hamburg (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 26 Aug 1987. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770276/JAW.

The test for the carcinogenetic effect of the hydrophilic fraction (≃ 25% by weight) and the hydrophobic fraction (≃ 75% by weight) of the diesel exhaust gas condensate and of sub-fractions of the hydrophobic part was carried through in the respiratory part of rats. The aim of the experiment was to identify the carcinogenic compounds and assess the action shares of the sub-fractions in the carcinogenicity of the total condensate. As a carcinogen-specific test model, lung implants in female Osborne Mendel rats of three months' age were chosen. After intrapulmonary application, the hydrophobic fraction only, containing the polycyclic aromatic compounds, led to the development of carcinomas. Upon breaking up the hydrophobic fraction into sub-fractions, polycyclic aromatic hydrocarbons with four rings or more were found to be predominantly responsible of the carcinogenicity of the total condensate, whereas the sub-fraction of nitro-polycyclic aromatic hydrocarbons accounted for only a small share. Polar polycyclic aromatic compounds and the sub-fraction of non-aromatic compounds and polycyclic aromatic compounds with 2 and 3 rings, though the largest sub-fraction by weight, proved ineffective. The condensate reconstituted from the hydrophobic parts exhibited a carcinogenic potential comparable to the non-fractioned part. Four percent of the total effect can be attributed to the benzo-a-pyrene present in the condensate.

20764 **(NP—9770281) Long-term animal inhalation experiment testing the carcinogenicity of PAH-enriched coal combustion emissions in combination with two metal compounds and crocidolite asbestos.** Heinrich, U.; Peters, L.; Rittinghausen, S.; Fuhst, R.; Levsen, K.; Pott, F. (Fraunhofer-Institut fuer Toxikologie und Aerosolforschung (ITA), Hannover (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). Sep 1987. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770281/JAW.

In a lifetime study with Syrian golden hamsters, the potential carcinogenic effect of a coal oven flue gas enriched with PAH from pitch pyrolysis was examined. One part of the animals was additionally treated with intratracheal applications of NiO, CdCl/sub 2/ or crocidolite asbestos in order to monitor any possible cocarcinogenic or syncarcinogenic effects. The animals were exposed for approx. 18 h/day, 5 days/week, over a period of 18 months and kept in clean air for a further 7.5 months. The average particle concentration of the exposure atmosphere was approx. 7 mg/m/sup 3/, with a BaP content of approx. 14 μm/mg of particles. The MMAD of the particles was approx. 0.8 μm. Exposure or treatment-dependent changes in the animals' mortality and body-weight development did not occur. An increase of non-neoplastic lesions in the respiratory tract in the shape of squamous cell metaplasia were only observed in the lungs of animals treated with combinations of metal compounds or asbestos, respectively, and the exhaust exposure. In the clean-air groups (with and without additional treatment), no tumors occurred in the respiratory tract. After combination treatment with exhaust and NiO or CdCl, significantly increased tumor incidences were found in the upper respiratory tract. Significant treatment-related neoplastic effects in the lungs could not be established. In the other organs, too, no indications of any exposure or treatment-dependent tumors were found. (orig.) With 15 refs., 8 tabs., 20 figs.

20765 **(NP—9770282) Testing PAH-enriched exhaust gas from coal combustion for carcinogenic and other chronic-toxic effects in animal experiments.** Heinrich, U.; Peters, L.; Fuhst, R.; Rittinghausen, S.; Puttins, U.; Koch, W.; Pott, F. (Fraunhofer-Institut fuer Toxikologie und Aerosolforschung (ITA), Hannover (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). Jun 1987. 118p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770282/JAW.

PAH-containing exhaust resulting from coal combustion was examined regarding its chronic-toxic, carcinogenic syncarcinogenic/cocarcinogenic effects in an inhalation study using hamsters and mice. However, the exhaust gas only showed a high PAH content during the ignition and initial burning phase of coal, whereas the values for the subsequent glowing phase were extremely low. PAHs were reintroduced into the latter exhaust gas applying various methods of generation. The BaP concentration was thus increased from an initial 0.2 ng/- m/sup 3/ up to 100 μg/m/sup 3/. The concentration of the acutely toxic components was hardly affected by this process. In a 10 weeks' preliminary experiment, the exhaust gas dilution suitable for the long-term study was determined as 1:10. The experimental animals were exposed for 16 hrs/day for 5 days a week. The exposure lasted 18 months for the hamsters and 5-23 months for the various experimental groups of mice. Some exposure groups were additionally treated with BaP, DENA, DBahA or urethan in order to detect possible syncarcinogenic or cocarcinogenic effects. In the upper respiratory tract of hamsters, only papillomas were induced by the exhaust gas. In combination with DENA, synergistic effects were observed. In the hamster group additionally treated with 3 mg BaP intratracheally, the inhalation of exhaust gas caused lung tumors (11%), in the animals treated with higher doses of BaP the basic tumor rate was in-

creased from 12.5 to 22%. Newborn mice proved to be especially sensitive as an experimental model for the carcinogenic effects of exhaust, but this effect could also be clearly observed in adult mice. There was no indication as to the development of any tumors on organs other than the respiratory tract. (orig.) With 18 refs., 52 tabs., 51 figs.

20766 **(ORNL/Sub—86-97383/1) US Air Force installation restoration program: Remedial investigation of former herbicide storage site at Johnston Island, Pacific Ocean.** (Oak Ridge National Lab., TN (USA). Hazwrap Support Contractor Office; Dames and Moore, Bethesda, MD (USA)). Sep 1988. Contract AC05-84OR21400. 482p. NTIS, PC A21 - OSTI. Order Number DE89007358/JAW.

This report represents a synthesis and reformatting of six primary documents and other related materials on soils, ocean sediments, air, and biota investigations conducted at Johnston Island (JI), Pacific Ocean, to characterize contamination resulting from storage of 1.37 million gallons of Herbicide Orange (HO) from 1972 through 1977. The individual study components comprise the Remedial Investigation (RI) of the former HO storage site at JI. This report describes the procedures, results, and conclusions of the sampling and analysis programs conducted at JI. Samples of site soils, ocean sediments, airborne particulates, dust, sweepings, and aquatic organisms were collected and analyzed for HO-derived 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and 2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD). Environmental media other than soils at the storage facility itself were found to be free of contamination or to contain very low contaminant concentrations. No contamination was found in ocean sediments, indicating possible dispersion of contaminants due to erosion. A few of the biological specimens collected were found to contain TCDD levels below the guidelines of 25 to 50 parts per trillion established by the US Food and Drug Administration; TCDD in all other biota samples was nondetectable. Analysis of samples of airborne particulates and of soils, dust, and sweepings from high-use and residential areas outside the boundaries of the former storage site indicated that there is little or no concern of adverse impacts from airborne transport and deposition of TCDD.

20767 **(PB—89-135123/XAB) Summary of selected new information on effects of ozone on health and vegetation: draft supplement to air-quality criteria for ozone and other photochemical oxidants. Draft report.** Costa, D.L.; Folinsbee, L.J.; Raub, J.A.; Tilton, B.E.; Tingey, D.T. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Criteria and Assessment Office). Nov 1988. 92p. (EPA—600/8-88/105A). NTIS, PC A05/MF A01.

Selected newer literature from 1986 through 1988 on the vegetation and health effects resulting from exposure to ozone is reviewed and summarized for the purpose of providing the Agency with information useful in identifying new data that may be relevant for developing primary and secondary National Ambient Air Quality Standards for Ozone.

20768 **(PNL—6829) Inhalation developmental toxicology studies: Teratology study of isoprene in mice and rats: Final report.** Mast, T.J.; Evanoff, J.J.; Stoney, K.H.; Westerberg, R.B.; Rommereim, R.L.; Weigel, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 322p. NTIS, PC A14 - OSTI. Order Number DE89008095/JAW.

Isoprene, a reactive, branched diene, is used in large quantities in the manufacture of polyisoprene and as a copolymer in the synthesis of butyl rubber. The potential for isoprene to cause developmental toxicity was assessed in rodents, by exposing four groups each of Sprague-Dawley rats and Swiss (CD-1) mice to 0, 280, 1400, or 7000 ppM isoprene vapors, 6 h/day, 7 day/wk. Each treatment group consisted of 10 virgin females (for comparison), and ~30 positively mated rats or mice. Positively mated mice were exposed on days 6-17 of gestation (dg), and rats on 6-19 dg. The day of plug or sperm detection was designated as 0 dg. Body weights were obtained throughout the study period, and uterine and fetal body weights were obtained at sacrifice (rats, 20 dg; mice, 18 dg). Implants were enumerated and their status recorded. Live fetuses were sexed and examined for gross, visceral, skeletal, and soft-tissue craniofacial defects. 31 refs., 6 figs., 19 tabs.

20769 **The significance of elevated levels of ozone on natural ecosystems of North America.** Taylor, G.E. Jr.; Norby, R.J. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp v of Evaluation of the scientific basis for ozone/oxidants standards. Lee, S.D. Pittsburgh, PA; Air Pollution Control Assoc. (1985).

This paper characterizes ozone (O/sub 3/) climatology in natural ecosystems of North America and discusses the consequences of sustained elevated O/sub 3/ levels on the physiology and growth of pollutant-sensitive forest trees, population genetic structure of sensitive species, forest community dynamics,and ecosystem structure and function. The analysis of O/sub 3/ air quality in the Shenandoah National Park, a representative forested ecosystem in eastern North America, shows a mean 7-hr daylight O/sub 3/ concentration during the growing season ranging from 0.04 to 0.06 ppm, with month-specific patterns of O/sub 3/ episodes and respites. Ozone concentrations and temporal patterns of O/sub 3/ air quality in the Shenandoah are not equivalent to those in either pristine or urban landscapes. As an anthropogenic stress influencing natural ecosystems, O/sub 3/ exhibits many unique ecological properties including high reactivity, rapid decomposition, ephemeral residence time in the ecosystem, and a widespread regional distribution. Because the theory and methods for addressing ecosystem responses to stress evolved from studies of acute localized perturbations, traditional ecological approaches may be unable to accurately evaluate ecosystem-level changes to chronic stresses whose effects are regional in scope.

57 HEALTH AND SAFETY

20770 **(LA—11507-MS) The HIT method: A hazard identification technique.** Howard, H.H.; Faust, C.L. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008310/JAW.

This report explains and demonstrates by example a technique for analyzing systems and operations to identify hazards and needed controls. The HIT method can be used both as a design tool and as a risk analysis tool. As a design tool, this method identifies requirements for design criteria. As part of a risk analysis effort, HIT identifies potential accident sequences, which can become part of the safety analysis documentation. Within this report the HIT method is described in detail with emphasis on application of the technique. Following the description is an example to illustrate the method. 7 figs.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 20116

20771 **(CSPG—8708) The Middle and Upper Devonian carbonate and evaporite sequence of southern Manitoba. Excursion B2.** McCabe, H.R. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 98p. (CONF-8708188—; CE—02346). , , , Canada ; $25.50 CAN.

From 2. international symposium on the Devonian system; Calgary, Canada (17 Aug 1987).

This document was prepared as a comprehensive guide to the Devonian outcrops of southwestern Manitoba. In addition to a road log and general outcrop descriptions, an introductory section is included which reviews the regional subsurface stratigraphy and tectonic framework of the region, in order to provide background for interpretation of the outcrop exposures. The Devonian is the largest hydrocarbon producing system in western Canada and understanding of its geology is of considerable importance for petroleum geologists. The Manitoba Devonian outcrop belt is located on the northeastern edge of the Western Canada Sedimentary Basin - a composite feature that includes the Elk Point Basin, which controlled deposition only during Devonian time, and the Williston Basin, which controlled deposition through the remaining post-Cambrian. A generalization is made regarding the nature of the out-

crop successions, that they are not marginal to the depositional basin but rather expose a series of dip sections of the basin which show the maximum possible isopach and lithofacies variation. Regional tectonic control is suggested for apparent anomalies in facies trends, as well as other related structural and stratigraphic anomalies. A more detailed discussion is made of the Elk Point Group of carbonates and evaporites, including reef morphology, salt collapse structures, and post-reef erosion, sedimentation, and diagenesis. 33 refs., 22 figs.

20772 **(CSPG—8708) Upper Devonian lithofacies and depositional environments, White Man Gap, Canmore, Alberta. Field excursion B6.** Leggett, S.R.; Hunter, I.G.; Bloy, G.R. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 65p. (CE—02354). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $16.50 CAN.

A guidebook is presented for acquainting petroleum geologists with some particularly well-exposed and accessible outcrops of Devonian reef complexes near Canmore, Alberta. The outcrops illustrate growth forms, sedimentary structures, and depositional environments of reefs similar to those of the Leduc Formation. Regional Upper Devonian geology is summarized to provide background material, and the depositional environments and sedimentology of the Cairn Formation, a dolostone unit in the study area, are described. Comparisons are made between the outcrops studied and core examples from the Swan Hills Snipe Lake carbonate buildup and the Leduc Golden Spike field. Brief mention is also made of the Southesk Formation, which outcrops at one section in the study area. 38 refs., 19 figs., 4 tabs.

20773 **(CSPG—8708) Fairholme stratigraphy and facies, Cripple Creek-Ram River area, Alberta. Field Excursion A7.** Elink, L.S.; Dooge, J.; Andrews, G.D. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 110p. (CONF-8708188—; CE—02361). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $28.50 CAN.

From 2. international symposium on the Devonian system; Calgary, Canada (17 Aug 1987).

This guidebook is intended for use in field trips to examine an Upper Devonian carbonate shelf edge that outcrops in the foothills, front ranges and main ranges of the Rocky Mountains in Alberta. The basinal shale to carbonate shelf transitions of the Fairholme Group seen in these outcrops are stratigraphically equivalent to the Leduc-Nisku (Woodbend-Winterburn Groups) reefs in the subsurface plains, which are Alberta's most important hydrocarbon reservoirs. The object of field trips to the Cripple Creek-Ram River study area of this guidebook is to visit one of these Leduc-type reef complexes in outcrop and appreciate it as a general model for carbonate shelf margins, as an example of an important reservoir type, and for itself. Indeed, the Cripple Creek area exposes a reef complex that illustrates a microcosm of Devonian reef and bank types, and the variability seen in outcrop illustrates the difficulties of predicting reservoir continuity with even close well spacing, let alone the problems facing explorationists in understanding reefal intervals with sparse control. The guidebook contains a summary of the major feature of the Fairholme outcrops, their stratigraphy and lithofacies, the kinds of structures that can be observed in the reef outcrops, suggested analogs to the subsurface, and a road log guide. 30 refs., 76 figs.

20774 **(CSPG—8708) Geology of the Devonian Fairholme Group, Cline Channel, Alberta. Field excursion A6.** Workum, R.H.; Hedinger, A.S. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 78p. (CE—02360). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $16.50 CAN.

This guidebook is intended for use during a field trip to examine the Cline Channel, a Frasnian area of southwestern Alberta characterized by basinal and open marine sediments situated between the Fairholme Carbonate Complex to the south and the Southesk Carbonate Complex to the north. Margins of the carbonate complexes and sediments of the channel are exposed on several thrust sheets in the Front Ranges and western foothills of the Rocky Mountains. The Channel provides an exceptional opportunity to view surface equivalents of the subsurface Leduc and Nisku Formations, major oil producers, and many of the sedimentary, stratigraphic and diagenetic relationships that exist between carbonate bank and basin. Lateral facies changes between carbonate complex and basin are recognizable, as are three different intervals of carbonate and shale basin-fill that have no shelf correlatives. The guidebook outlines the basic surface stratigraphic framework for the Frasnian stage of the Devonian of the Alberta Rocky Mountains, and then presents details on specific highlights of the Channel, mostly at the margins. It is shown that surface analogs of the Golden Spike (Leduc and Nisku) reefs are present in the vicinity of the Cline Channel. 47 refs., 33 figs.

20775 **(CSPG—8708) The Middle and Upper Devonian of the Hay River region, southern district of Mackenzie, N.W.T. Field excursion A2.** McLean, R.A.; Marchant, T.R.; Jones, B.; Carter, K.M. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 91p. (CE—02359). CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $23.00 CAN.

This guidebook is intended for use in a field trip to examine a variety of outcrops within the Frasnian sequence of the southern District of Mackenzie, Northwest Territories. The objective of the trip is to familiarize petroleum geologists with the outcrops of the Hay River, Twin Falls, Tathlina, Fort Simpson, Redknife, and Kakisa Formations, their lithofacies, stratigraphy, and fossils. Because of the general lack of structural complexity and significant dolomitization, these strata provide a unique opportunity to examine both facies and fossils in a relatively undisturbed state. Stratigraphic equivalents of a number of the units examined form significant hydrocarbon reservoirs in the Alberta Basin to the south. 48 refs., 30 figs.

20776 **(CSPG—8708) The Upper Devonian ancient wall reef complex, Jasper National Park, Alberta. Field excursion A5.** Mountjoy, E.W. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 63p. (CE—02355). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $18.50 CAN.

The Devonian sequences of the western Alberta Basin, both in the subsurface and in Rocky Mountain outcrops, are widely known for their excellent preservation of depositional textures and for their reefs, many of which are hydrocarbon-bearing. These reefs are actually stromatoporoid-fringed, well-stratified buildups or banks, which can be shown to have been constructed in situ by frame-building organisms only in a few areas. The mid-Frasnian Ancient Wall reef complex is well exposed in two separate thrust sheets north of Jasper. The exposures permit a nearly 3-dimensional reconstruction of the reef. This guidebook examines reef sections of the Colin thrust sheet. A review is presented of the geological setting, the Upper Devonian depositional environment and stratigraphy, and the nomenclature of the Southesk Formation, which is one of the formations in the Ancient Wall buildup. Four major lithofacies of the buildup sequence are detailed along with the depositional history of the sequence. Later burial history and diagenesis is also reviewed. A route log, used for a field trip to examine the Ancient Wall sections, is also included. 88 refs., 48 figs., 1 tab.

20777 **(CSPG—8708) Upper Devonian Fairholme Stratigraphy and sedimentation, Burnt Timber Embayment, southern Alberta. Field excursion B3.** Tebbutt, G.E.; Weissenberger, J.E.W. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 34p. (CE—02358). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $20.50 CAN.

This guidebook has been compiled for use during a field trip to examine several carbonate reef and off-reef sections in the Upper Devonian Fairholme Group in Alberta. Details are presented on three principal features: the southern margin of a small embayment in the reef complex; an off-reef or basinal sequence; and the northern margin of the same embayment. The structural and stratigraphic setting of the study area is also summarized. An attempt is made throughout the guide to illustrate as accurately as possible the relationships between stratigraphic units mapped in surface exposures in the Rocky Mountains and those recognized, mainly by oil com-

panies, in the subsurface of the Alberta foothills and plains. 38 refs., 13 figs.

20778 **(CSPG—8709) Sedimentology of sandstone reservoirs: case studies.** Leckie, D.; Rosenthal, L. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 62p. (CE—02353). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $11.00 CAN.

Case studies of a number of sandstone reservoirs in Alberta and British Columbia are presented. These studies cover stratigraphy, log interpretation, drill cores, depositional history and environments, lithology, sedimentary structures, facies description, and petroleum occurrences. Specific formations included are: the Falher Member of the Spirit River Formation, used to show regional environmental interpretation made primarily by log correlations; point bar deposits of the Gething Formation; braided fluvial deposits of the Cadomin Formation; wave-dominated shoreline sequences of the Falher Member; shoreline facies of the Cardium Formation; tidal inlet reservoirs of the Halfway Formation; shelf sands of the Doe Creek Member of the Kaskapau Formation; tidally influenced, regressive shelf deposits of the Viking Formation; and the Glauconite Formation, used to demonstrate how integrated core, log and petrographic data can be compiled to solve complex stratigraphic and sedimentological problems. 7 refs., 37 figs.

20779 **(CSPG—8709) Sedimentology of sandstone reservoirs: course notes.** Leckie, D. (Canadian Society of Petroleum Geologists, Calgary, Alberta). 1987. 162p. (CE—02352). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A OG1; $24.00 CAN.

This document is intended to be used to demonstrate to exploration geologists how much data is required, and how different forms of data (cores and isopachs) are integrated, in order to generate an accurate interpretation of depositional environments and geological history of a sedimentary structure. The focus is on four elements of clastic sedimentology: lithology, grain size and textural variations, physical sedimentary structures, and presence or absence of sequences and nature of contacts between various facies. The flow regime concept is introduced and sedimentary structures are described that will be encountered in core outcrop. Depositional environments covered in this document include rivers, interchannel areas, deltas, strandplains, barrier islands, shorelines, and shelves. Ways of reading the record of the depositional environments and history represented by the various facies are discussed. In order to familiarize explorationists with the sedimentology and regional geology of Western Canadian Sedimentary Basin reservoirs, a guide is included for a field trip to examine the Chungo Sandstone and Belly River Formation in southern Alberta. 89 refs., 98 figs., 5 tabs.

20780 **(DL—8503) CO/sub 2/ climate literature review. Phase 4, paleoclimatology. Summary report.** (Dillon (M.M.) Ltd., Ottawa, Ontario (Canada)). 1985. 50p. (CE—02364). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report provides a summary of present understanding of global climates during the past warm periods, particularly as they were manifested in Canadian regions. Primary emphasis in this literature survey was placed on climates during the last interglacial, the peak of the present interglacial, and the warm periods of the last 1,000 years. It is seen that in the last million years, glacial periods indicate that temperatures have often been colder than at present. Warmer intervals can be grouped on the basis of general time periods and the expected precision with which the climate record can be read. The continuous increase in manmade atmospheric carbon dioxide is expected to have a warming effect on the global climate, returning to conditions more prevalent during past warm periods. Global climate changes have not been synchronous; however, earth warming caused by CO/sub 2/ increase may be. Even small changes in climate have caused major biospheric changes, which can have an effect on carbon cycling. Temperature changes have frequently been accompanied by changes in the effective available moisture; moisture effects of climatic warming may bring greater near-term direct impacts to Canada than temperature effects. During the Canadian Holocene, elevated temperatures generally appear to have been followed initially by dry conditions, with precipitation increasing later to provide warm and moist conditions. Such a pattern occurred from west to east across Canada over thousands of years. 129 refs.

20781 **(EMR—88-8) Permian conodont biostratigraphy of the Harper Ranch Beds, near Kamloops, south-central British Columbia.** Orchard, M.J.; Forster, P.J.L. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1988. 29p. (MICROLOG—88-05184). Canada. Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $5.00 OTHER COUNTRIES $6.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this study was to determine the nature and succession of conodont faunas (as important stratigraphic marker) within the Permian part of the Harper Ranch Group. The results provide a standard against which conodont faunas from other juxtaposed Cordilleran terranes may be compared. In the area around a Kamploops quarry, the Permian Harper Ranch beds comprise a succession of structurally stacked, bedded carbonate. New conodont collections include 21 conodont taxa and are assigned to 5 faunas and 2 subfaunas which are dataed as late Wolfcampian (late Sakmarian) through late Leonardian. Some of the conodonts are not known within autochthonous American sequences but are known from Japan and China, implying a western paleo-Pacific influence. Similarly, the range of some taxa is anomalous compared with North American sequences but are similar to Asiatic records. Early Permian geographic separation from North America is favoured as an explanation, although divergent species concepts may also account for some discrepancies. The taxonomy of the stratigraphically important Neostreptognathodus, Neogondolella and Sweetognathus is reviewed. A study of fauna, condonont biofacies, and carbonate lithofacies of the Harper Ranch beds indicate a progressive increase in water depth in the study area during the Early Permian. 55 refs., 7 figs., 3 tabs.

20782 **(LUNBDS-NBGK—1021-1-9-1988) Reconstructing climate from lake level changes.** Harrison, S.P. (Lund Univ. (Sweden). Dept. of Quaterny Geology). Feb 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757055/JAW.

The Late Quaternary geological record from lakes can be used to reconstruct changes in water depth and surface area. These changes reflect changes in the local hydrological balanse. Regionally synchronous changes in the hydrological balance are climatically determined. Compilations of lake-level data at a regional to continental scale can be used to infer changes in major features of the general circulations as expressed by changes in airmass trajectories and mean boundary positions. The first paper describes the methodology of lake-level reconstruction, regionalsynthesis and climatic inference. The remaining papers deal with the Late Quaternary lake-level record from north America. Spatially coherent patterns in the data reflect changes in the strength and position of the westerlies, which determine the relative influence of different airmasses. A specially devised numerical technique identifies four clusters of lakes with similar behavior. These cluster are geographically coherent and consistent with the hypothesized changes in circulation. An expanded lake level data set from western Canada shows patterns consistent with climatic interpretations from pollen data. These patterns are explained as a result of the direct effect of insolation changes on evaporation and the effects of changes in circulation on precipitation. Regional water-balance reconstructions based on an expanded data set from eastern North America are compared with published GCM (General Circulation Models) simulations, to test the hypothesis that the climate changes were determined by insolation and ice-sheet changes. Data and model show similar paterns but the model displaces some climatic boundaries because of its limited spatial resolution.

20783 (N—89-14842, pp 115-127) **Lunar hydrogen: a resource for future use at lunar bases and space activities.** Gibson, E.K. Jr.; Bustin, R.; Mckay, D.S. (Arkansas Coll., Batesville (USA)). Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

Hydrogen abundances were determined for grain size separates of five lunar soils and one soil breccia. The hydrogen abundance studies have provided important baseline information for engineering models undergoing study at the present time. From the studies is appears that there is sufficient hydrogen present in selected lunar materials which could be recovered to support future space activities. It is well known that hydrogen can be extracted from lunar soils by heating between 400 and 800 C. Recovery of hydrogen for regolith materials would involve heating with solar mirrors and collecting the released hydrogen. Current baseline models for the lunar base are requiring the production of 1000 metric tons of oxygen per year. From this requirement it follows that around 117 metric tons per year of hydrogen would be required for the production of water. The ability to obtain hydrogen from the lunar regolith would assist in lowering the operating costs of any lunar base.

20784 (N—89-14842, pp 147-157) **Economic geology of lunar helium-3.** Schmitt, H. H. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

Economic geology evaluation of lunar He-3 should answer the question: Can lunar He-3 be sold on Earth with sufficient profit margins and low enough risk to attract capital investment in the enterprise. Concepts that relate to economic geology of recovering He-3 from the lunar maria are not new to human experience. A parametric cost and technology evaluation scheme, based on existing and future data, is required to qualitatively and quantitatively assess the comprehensive economic feasibility and return on investment of He-3 recovery from the lunar maria. There are also many political issues which must be considered as a result of nuclear fusion and lunar mining.

20785 (N—89-14842, pp 159-168) **Mining for helium: Site selection and evaluation.** Cameron, E.N. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

Part of the University of Wisconsin study of the feasibility of recovering He-3 from the moon is selection and evaluation of potential mining sites. Selection and evaluation are based primarily on salient findings by investigators: (1) Regoliths from areas underlain by highland materials contain less than 20 wppm He; (2) Regoliths of certain maria or parts of maria also contain less than 20 wppm He, but mare regoliths at the Apollo 11 and 17 sites contain 25 to 49 wppm He; (3) The helium content of a regolith is a function of its composition; and (4) Helium is concentrated in the -50 micron size fractions of regoliths. In site selection, the concern is with the compositions of lunar regoliths, in particular with their titanium contents. It is widely accepted that compositions of mare regoliths are controlled by the nature of the underlying basalts from which the regoliths are largely derived. The distribution and extent of the three groups of basalts and the regoliths derived from them are the first basis for site selection and evaluation. Other considerations are briefly discussed.

20786 (N—89-14842, pp 193-210) **Synergism of He-3 acquisition with lunar base evolution.** Crabb, T.M.; Jacobs, M.K. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

It is shown how acquisition of He-3 affects Lunar Base development and operation. A four phase evolutionary Lunar Base scenario is summarized with initial equipment mass and resupply requirements. Requirements for various He-3 mining operations are shown and available by-products are identified. Impacts of mining He-3 on Lunar Base development include increases in equipment masses to be delivered to the lunar surface and a reduction of Lunar Base resupply based on availability of He-3 acquisition by-products. It is concluded that the acquisition of this valuable fusion fuel element greatly enhances the commercial potential of a Lunar Base.

20787 (N—89-14842, pp 227-231) **Assessment of lunar sources of He-3 for use on earth.** English, R.E. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

As a gross measure of the economics of mining lunar sources of He-3, the energy densities (GJ/ton) of lunar soils were compared with the energy densities of various existing and future terrestrial sources of energy. On this basis, only the very richest lunar ores appear competitive with coal. Future lunar exploration might emphasize identification of lunar soils having higher concentrations of He-3.

20788 **(RISO-M—2715) Survey of archaeological samples dated in 1987.** Mejdahl, V. (Risoe National Lab., Roskilde (Denmark)). Oct 1988. 29p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE89780061/JAW.

A survey is given of archaeological samples dated in 1987 at the Nordic Laboratory for Thermoluminescence Dating. A total of 74 samples were dated. The results were corrected for short-term fading of feldspars as measured for samples stored at room temperature for four weeks or at 100 deg. C for two weeks. The beta dose from potassium and rubidium in feldspar, and the alpha dose from uranium and thorium in quartz and feldspar were included, assuming alpha efficiency factors of 0.1 for quartz and 0.2 for feldspar. (author) 20 tabs., 29 refs.

5802 Geophysics

REFER ALSO TO CITATION(S) 19368, 19625, 19626, 19627, 19628, 19629, 19630, 19631, 19632, 19650, 20118

20789 **(DOE/ER/13221—T4) A comprehensive study of the seismotectonics of the eastern Aleutian arc and associated volcanic systems: Summary of research for the project period 1987 to 1988.** Taber, J.; Jacob, K.H.; Boyd, T.; Estabrook, C. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Nov 1988. Contract FG02-84ER13221. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007357/JAW.

We have made significant progress in the past two years towards our goal of understanding fundamental processes of subduction. The results range in spatial dimensions from small scale details of the plate interface within the Shumagin seismic gap to updated probabilities of the occurrence of great earthquakes along the entire Aleutian arc, and in time from the earliest instrumentally recorded earthquakes to automatic processing of the most recent events. It is necessary to study the entire range of scale lengths because of the interaction between different tectonic elements. A simple kinematic model describing flow of material down the Aleutian subduction zone shows that arc geometry and current convergent directions and rates can explain the distribution of seismicity and volcanism along the arc. Studies of the seismic source have begun to expand the frequency band over which seismic rupture can be analyzed. A comparison of short and long-period data from the Andreanoff Island earthquake raises fundamental questions about how decoupled in space and time can the radiation of high frequency energy be from the release of moment-rate producing slip during a dynamic rupture. The basic source parameters were modeled by inverting long-period P and SH waves while the high frequency characteristics were approximated by the superposition of many small earthquakes used as empirical Green's functions. Modeling of the earthquake source has also added insight into the mechanics of the transition from subduction zone to transform fault in the Gulf of Alaska region. 34 refs., 19 figs.

20790 **Numerical models of Plinian eruption columns and pyroclastic flows.** Valentine, G.A.; Wohletz, K.H. (Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Geophysical Research;* **94**: No. B2, 1867-1887(10 Feb 1989).

Numerical simulations of physical processes governing the large-scale dynamics of Plinian eruption columns reveal conditions contributing to column collapse and emplacement of pyroclastic flows. The simulations are based on numerical solution of the time-dependent, two-phase, compressible Navier-Stokes equations for jets in a gravitational field. This modeling effort is directed toward studying the steady discharge phase of eruptions in contrast to our previous models of the initial, unsteady blast phase. Analysis of 51 eruption models covers a wide range of vent exit pressures, inertial and buoyancy driving forces, and coupling of energy and momentum between gas and pyroclasts. Consideration of three dimensionless groups (Richardson and Rouse numbers and thermogravitational parameter) facilitates this analysis and defines conditions leading to column collapse. For eruptions with similar particle size characteristics, exit pressure ratios are also very important in determining column behavior; column behavior is much more sensitive to exit pressure ratio than to the density ratio between the column and the atmosphere. Model eruption columns with exit pressures exceeding atmospheric pressure have diamond-shaped patterns at their bases with internal dynamics that correspond closely to observations of overpressured jets in laboratory experiments. Collapsing fountains form pyroclastic flows that consist of low-concentration fronts, relatively thick heads, vortex development along the top surfaces, and rising clouds of buoyant ash. The presence of coarse-grained proximal deposits primarily reflects tephra size sorting within the eruption column before collapse, as opposed to that which occurs during lateral transport of the material in pyroclastic flows.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 19206, 19293, 19466

20791 **(BGS-R—19-Pt.4) Lithium potential of the St Austell Granite.** Hawkes, J.R.; Harris, P.M.; Dangerfield, J.; Strong, G.E.; Davis, A.E.; Nancarrow, P.H.A.; Francis, A.D.; Smale, C.V. (British Geological Survey, Keyworth; ECC International Ltd., St. Austell (UK); Goonvean and Rostowrack China Clay Company Ltd., St. Austell (UK)). (British Geological Survey, Keyworth). 1987. 54p. H.M. Stationery Office, London, price Pound 6.75.

This report illustrates the size of the lithium resource contained in the St Austell Granite. Data suggest that just over 3 million tonnes of lithium in part of the top 100 m constitute a realistic economic target. Almost all the lithium occurs in micas which range in composition from siderophyllite (0.5 wt per cent Li) to ferroan lepidolite (2.2 to about 2.5 wt per cent Li). Recovery of the mica could easily be achieved as a by-product of china clay operations, so that mining costs might be negligible. Well-tried beneficiation techniques could support the production of a mica-concentrate assaying at about 2 per cent Li. To minimise transport costs of such an inherently low-grade material, on-site conversion to lithium carbonate would be a necessity.

5805 Oceanography

20792 **(DOE/ER/60351—4) Nearshore transport processes affecting the dilution and fate of energy-related contaminants: A one-year progress report, January 1988--January 1989.** Blanton, J.O. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 10 Feb 1989. Contract FG09-85ER60351. 118p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008282/JAW.

The conceptual models of cross-shelf exchange developed over the past several years have lead us to hypothesize that the inner shelf circulation induced by fluctuating alongshore wind stress provide the ingredients that store or evacuate dissolved and particulate matter that is formed at or near the coastal boundary. Two experiments were conducted under opposing wind stress directions to measure the advection of low salinity water across the coastal boundary zone (CBZ). The measured current profiles from those experiments showed where in the water column low-salinity water was advected offshore. The basic findings of these detailed experiments have been confirmed by models and subsequent field experiments. Under an autumn-like wind regime (southwestward stress), surface waters are transported shoreward where they encounter the buoyant, less dense waters of the coastal frontal zone. Wind stress and bottom friction also act to destroy stratification induced by the buoyancy flux of freshwater. Thus the water in the CBZ is vertically homogeneous under these wind conditions, but there is still a strong horizontal density gradient present. Since water has been piled up against the coast by the onshore flux of water, there is an offshore pressure gradient force which pushes nearshore flux of water, there is an offshore pressure gradient force which pushes nearshore water offshore. The vertically averaged currents have an offshore component which diminishes with offshore distance across the CBZ as the flow comes into geostrophic balance with the offshore pressure gradient force. 18 refs., 20 figs., 10 tabs.

20793 (NRC/ACGR—NRCC28003TM41, pp 413-429) **Preliminary observations on compressive strength, deformation and Poisson's ratio of iceberg ice.** Sinha, N.K.; Frederking, R. 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Icebergs represent a hazard to navigation and to offshore structures on the East Coast of Canada. In an effort to improve knowledge on the strength and deformation of iceberg ice, compressive strength tests at relatively low strain rates were performed on ice obtained from a large block that had fallen from an iceberg in Lancaster Sound. The ice exhibiting elongated grains and bubbles with an oriented fabric, and was tested uniaxially at -10/sup 0/ C under closed-loop controlled constant specimen strain rates with load applied parallel to the long axis of the grains and hence the bubbles. The average grain size was 8.5 mm and the porosity was 2.8%. An upper yield type of failure occurred in the strain rate range of 1 x 10/sup -7//to 1 x 10/sup -4/ s/sup -1/. The strength increased from 1.1 megapascals (MPa) to 4.9 MPa in theis range. Premature fracture occurred at a stress level of 5.5 MPa for a strain rate of 3 x 10/sup -4/ s/sup -1/. Axial failure strains were less than 0.2%. Deformation modulus at peak stress increased from 0.6 Gigapascals (GPa) to 6.0 GPa. With deformation the transverse strain rate asymptotically approached a constant values at 1 x 10/sup -7/ s/sup -1/ but the transverse strain rate monotonically increased at 1 x 10/sup -4/ s/sup -1/. Strain ratio at failure increased from 0.32 at 1 x 10/sup -6/ s/sup -1/ to 0.64 at 3 x 10/sup -4/ s/sup -1. This increase is associated with the increase in cracking activity. 6 refs., 8 figs.

20794 (NRC/ACGR—NRCC28003TM41, pp 405-412) **Oxygen isotope evidence of freshwater pools and ice accretion below multiyear landfast sea ice, northern Ellesmere Island.** Jeffries, M.O. (Univ. of Alaska, Fairbanks, USA). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Salinity and oxygen isotope measurements from thick sea ice cores off the north coast of Ellesmere Island are briefly examined. Data from undeformed multi-year landfast sea ice (MLSI) show evidence of pronounced annual layers that arise from ice growth associated with freshwater-seawater stratification below the ice. Furthermore, a large part of the sea ice is composed of freshwater. Annual layers are not evident in a core from deformed MLSI which has salinities of as much as 12.1 parts per thousand. Oxygen isotope values at the bottom of the core indicate that freshwater-

seawater stratification occurred only after deformation. 7 refs., 3 figs.

20795 (NRC/ACGR—NRCC28003TM41, pp 385-401) **The surface waveforms on the Ellesmere Island ice shelves and ice islands.** Holdsworth, G. (National Hydrology Research Inst., Saskatoon, Sask.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Surface waveforms are a dominant topographic feature of the ice shelves of northern Ellesmere Island and of the ice islands which are derived from them. Their exact mode of formation still remains unclear but it seems to involve a dynamic process associated with ice creep deformation during extreme events in the pack ice. A systematic review of hypotheses advanced to explain the origin of the waves is presented. It is found that no new hypothesis seems to be necessary, only development of one particular theory combined with elements from another theory. Justification for studying the origin and geometry of these surface waves is based on satisfying safety requirements for aircraft operating on ice shelves and ice islands, and obtaining the opportunity to study the fundamental dynamics of thin ice shelves and their interaction with the pack ice that is in intimate contact with them. The conclusions of this study have implications to the field of pack ice-structure interactions. 28 refs, 3 figs.

20796 (NRC/ACGR—NRCC28003TM41, pp 373-382) **Extreme ice feature maps of the Arctic Ocean derived from data recorded by nuclear submarines.** LeSchack, L.A. (LeSchack Associates Ltd., Calgary, Alta.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Under-ice profile data from Arctic Ocean cruises of USS SARGO (winter, 1960), USS SEADRAGON (summers of 1960 and 1962), and USS SKATE (summer of 1962), have been digitized and recorded on 9-track tape. Along with data recorded by HMS SOVEREIGN (spring, 1976), 363 separate ice draft probability distributions (1-m depth intervals), covering the entire Arctic Ocean basin have been developed. Each draft distribution is derived from nominally 50-km lengths of contiguous profile data along each of the cruise tracks. These draft distributions also have been recorded on tape. Computations from these data are the basis for preparing contour maps of mean ice depth, standard deviation about the mean, percent open water/thin ice, and probability of encountering deep draft ice (>30 m). A Zycor, contour-tracing algorithm was used to map these four parameters on a North Pole-centered Transverse Mercator base. Geographical locations of extreme ice features are clearly depicted on these maps. 9 refs., 4 figs, 1 tab.

20797 (NRC/ACGR—NRCC28003TM41, pp 155-192) **Survey of physical and mechanical properties of icebergs.** Nadreau, J.-P. (Memorial Univ., St. John's, Nfld.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Production of oil in the eastern Canadian offshore environment requires offshore structures able to cope with the presence of icebergs, which can interact with the structure and can also scour the sea floor, endangering pipelines. The vast majority of such icebergs originate in Greenland by calving from glaciers. This paper presents a review of the behavior of these icebergs, including mechanism of formation, drift patterns, iceberg fluxes, mass and draft, iceberg temperatures, stability and erosion, velocity, and mechanical properties of iceberg ice. A number of gaps in knowledge are identified, notably the underwater morphology of icebergs, instantaneous velocity values of icebergs in various sea states, and iceberg strength at high strain rates and for large areas of impact. 36 refs., 29 figs., 1 tab.

20798 (NRC/ACGR—NRCC28003TM41, pp 81-118) **Multi-year ice statistics.** Spedding, L.G.; Hill, M.C. (Esso Research Canada Ltd.; Geographic Services). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

Multi-year ice incursions into southern Beaufort Sea coastal waters of less than 100 metres tend to be both irregular and sporadic in their occurrence and severity. However, the largest regular forces likely to be encountered by an offshore structure will be exerted by multi-year ice. Within the past decade, numerous studies of the multi-year ice environment have been conducted in order to determine probabilistic ice design loads. These studies have examined multi-year ice frequency of occurrence, concentrations, flow size distributions, surface morphology, ridge height, and keel depths along with mean ice thicknesses. This paper reviews and summarizes the available data covering these subject areas. 42, refs., 27 figs.

20799 (NRC/ACGR—NRCC28003TM41, pp 53-66) **Loss, decay, and recent drift of ice islands.** Sackinger, W.M.; Yan, M. (Univ. of Alaska, Fairbanks, USA). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

The sequence of possible motions of Arctic ice islands, those extreme ice features which have the possibility of causing problems for offshore structures, is reviewed in this paper, based on the few records that exist of ice island behavior. An equation of motion for an ice island is presented, and the behavior of an island monitored by Hobson (1983) is examined in more detail. The trajectory of Hobson's ice island near the coast of Ellesmere Island shows three categories of movement episodes: large movements towards the southwest, medium movements (1-10 km) in two sequentially opposite directions along the coastline, and small random movements in any direction. Evidence from surface pressure maps shows that an offshore geostrophic wind component is a necessary condition in the initial stages of the large and medium movements in the southwest direction. Ratios of ice island speed to geostrophic wind speed range from 1.0% to 1.5% for the first type of movement. The average angle between ice island movement direction and geostrophic wind direction. Force balance calculations show that the large Coriolis force on the massive, moving ice island is balanced by a reaction force from the pack ice action upon the ice island boundary. 12 refs., 6 figs.

20800 (NRC/ACGR—NRCC28003TM41, pp 39-48) **Structure and growth of Arctic ice shelves and ice islands.** Jeffries, M.O. (Univ. of Alaska, Fairbanks, USA). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

In the Arctic Ocean, ice islands are the largest known extreme ice features (those features which can cause problems for an offshore structure). Knowledge of the growth and structure of Arctic ice shelves and ice islands is the result of sporadic investigations since the early 1950s. This paper is a brief review of that work. Present ice shelf extent is outlined and it is shown that the seven remaining ice shelves owe their origin to a variety of growth processes. The largest ice shelf, Ward Hunt Ice Shelf, has grown in-situ and it is shown that the internal structure is not homogeneous due to spatial variation below the ice. Calving of ice from the ice shelves creates ice islands but the causes of calving are unknown. There are presently about 25 ice islands off Axel Heiberg and Ellesmere Islands. 16 refs., 3 figs.

20801 (NRC/ACGR—NRCC28003TM41, pp 11-36) **Beaufort Gyre ice trajectory.** Cornett, S. (Dome Petroleum, Calgary, Alta.). 1987. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8611284—; MICROLOG—88-04443).

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

The Beaufort Gyre is one of the major currents in the general surface circulation of the Arctic Ocean, and is a means by which extreme ice features (those which could cause problems for offshore structures) are capable of entering the Beaufort Sea. This paper examines the regional ice movement within the Gyre. A brief summary of the driving forces and publicly available ice drift data is followed by a detailed discussion of the trajectories including average speed and directions, seasonal and geographical variations and distributions of velocities. It was noted that the speed and direction of ice drift shows derfinite variation according to geographical location in the Gyre. Further, the influence of synoptic atmospheric circulation patterns was found to be related to seasonal variations in ice conditions. Seasonal trends in ice drift speeds and meandering coefficients were also observed. The paper concludes with an assessment of the current state of research on the topic and suggestions for future work. 33 refs., 6 figs., 1 tab.

20802 **(NRC/ACGR—NRCC28003TM41) Workshop on extreme ice features.** Pilkington, G.R. (comp.); Danielewicz, B.W. (comp). (National Research Council of Canada, Ottawa, Ontario. Associate Committee on Geotechnical Research). 1987. 451p. (CONF-8611284—; MICROLOG—88-04443). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, Canada K1A 0R6; $20.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Extreme ice features workshop; Banff, Canada (3 Nov 1986).

An extreme ice feature is one which causes a problem for an offshore structure. A workshop was conducted to discuss all aspects of these features which could present serious problems for fixed offshore production structures in the Canadian Arctic and East Coast. The design and operation of such structures depends on the number, distribution, and shape of ice islands and hummock fields in the Beaufort Sea and icebergs off the East Coast. Ice strength, modes of failure and effective ice pressures are also necessary types of information required for determining possible effects of such features. Topics covered by the papers pressented include ice drift trajectories, mechanical properties of ice, ice-structure interactions, risk analysis, remote sensing, emergency response to ice hazards, and offshore activity in the Norwegian Arctic. Separate abstracts have been prepared for 19 papers from this workshop.

20803 **In situ monitoring of ocean chlorophyll via laser-induced fluorescence backscattering through an optical fiber.** Cowles, T.J.; Moum, J.N.; Desiderio, R.A.; Angel, S.M. (Oregon State University, College of Oceanography, Corvallis, Oregon 97331). *Applied Optics;* **28**: No. 3, 595-600(1 Feb 1989).

The first seagoing test of a prototype laser/fiber-optic system for in situ detection of ocean chlorophyll fluorescence is described. Radiation at 488 nm originating from a shipboard argon laser was transmitted through 20 of 200-μm core optical fiber to the distal tip mounted on the microstructure profiler, the Rapid Sampling Vertical Profiler. The backscattered fluorescence emission signal was collected through the same fiber and processed on board ship. A series of measurements indicated that (1) successful isolation of ship-induced vibrations could be achieved using our optical bench framework to maintain optical alignments; (2) ambient chlorophyll concentrations could be detected in situ; (3) a Raman scattering signal from water could also be detected and should provide an internal standard against which chlorophyll fluorescence may be calibrated.

64 PHYSICS I

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 19427, 20428, 20741, 21092, 21347

20804 **(DOE/ER/40272—73) Generating a hot big bang via a change in topology.** Kandrup, H.E.; Mazur, P.O. (Florida Univ., Gainesville (USA). Dept. of Physics). Jan 1989. Contract FG05-86ER40272. 7p. (CONF-881268—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007561/JAW.

From 14. Texas symposium on relativistic astrophysics; Dallas, TX, USA (11 Dec 1988).

The objective here is to use ideas developed recently in semiclassical quantum gravity to provide a possible explanation of the Hot Big Bang generally assumed in cosmology. 18 refs.

20805 (INIS-BR—1424, pp 9) **Field theory in a curved space-time: a soluble model.** Costa, I.; Novello, M.; Svaiter, N.F.; Deruelle, N. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ; Paris-6 Univ., 75 (France). Inst. Henri Poincare). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20806 (INIS-BR—1424, pp 9) **Quantum field theory in non-stationary coordinate systems and Green functions.** Svaiter, N.F.; Svaiter, B.F. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20807 (INIS-BR—1424, pp 10) **Extreme black holes: stable universes and particles.** Zanchin, V.T.; Recami, E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Matematica, Estatistica e Ciencia da Computacao). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20808 (INIS-BR—1424, pp 10) **Role of the matter equation of state in FRW-like cosmologies.** Calvao, M.O.; Lima, J.A.S. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ; Rio Grande do Norte Univ., Natal (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20809 (INIS-BR—1424, pp 10) **Inhomogeneous cosmological models with dissipative fluids.** Motta, D.C. (Universidade Federal Fluminense, Niteroi, RJ (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20810 (INIS-BR—1424, pp 22) **Thermodynamics of the Szekeres-like inhomogeneous models with perfect fluid.** Lima, J.A.S. de; Tiomno, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20811 (INIS-BR—1424, pp 23) **Cosmologies out of equilibrium.** Novello, M.; Oliveira, H.P.; Salim, J.M.; Torres, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20812 (INIS-BR—1424, pp 23) **Exact solutions in the Brans-Dicke theory.** Romero, C.; Oliveira, H.P. (Paraiba Univ., Joao Pessoa (Brazil); Universidade do Estado do Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20813 (INIS-BR—1424, pp 11) **Cerenkov detector for neutrino astrophysics.** Badino, G.; Turtelli Junior, A.; Martin, I.M.; Chinellato, J.A.; Fauth, A.C.; Manganote, E.J.T.; Silva, N.M. (Consiglio Nazionale delle Ricerche, Turin (Italy). Lab. di Cosmo-Geofisica; Universidade Estadual de Campinas, SP (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20814 (INIS-BR—1424, pp 12) **Measurements of sideral variations in Chacaltaya and in the brazilian Antartic station.** Chinellato, J.A.; Fraguas, G.B.; Manganote, E.J.T. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20815 (INIS-BR—1424, pp 13) **Fine structure of showers produced by hadrons in the lead.** Amato, N.M.; Arata, N. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20816 (INIS-BR—1424, pp 13) **Centauro event.** Shibuya, E.H. 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20817 (INIS-BR—1424, pp 15) **Use of stratospheric balloon to detect electromagnetic and cosmic radiations.** Bui-Van, N.A.; Martin, I.M.; Turtelli Junior, A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20818 (INIS-BR—1424, pp 15) **Time variation of the cosmic radiation in the low atmosphere of the brazilian magnetic anomaly region.** Martin, I.M.; Bui-Van, N.A.; Turtelli Junior, A.; Stozhkov, Y.I.; Sibikin, V.V. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica; Lebedev Physical Inst. Moscou (USSR)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20819 (INIS-BR—1424, pp 16) **High energy particle multiple production.** Navia, O.C.E.; Maldonado, R.H.C.; Portella, H.M.; Pinto, H.V.; Pinto, F.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20820 (INIS-BR—1424, pp 24) **Study of the one-dimensional diffusion equation for the cosmic radiation nucleonic component in the atmosphere.** Bellandi Filho, J.; Dobrigkeit, C.; Chinellato, J.A.; Brunetto, S.Q.; Ohsawa, A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica; Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20821 (INIS-BR—1424, pp 24) **Nucleon diffusion equation inthe atmosphere and non-poissonian distribution of the interactions.** Portella, H.M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20822 (INIS-mf—11358, pp 59) **Rate of energy loss from pulsars.** De Jager, H.I.; De Jager, O.C.; Raubenheimer, B.C. (PU-CSIR Cosmic Ray Research Unit, Potchefstroom (South Africa)). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).
This publication contains only the abstracts of seminars.

20823 (INIS-mf—11358, pp 59) **Nucleon superfluids in neutron stars.** Clark, J.W. (Institute of Theoretical Physics and Astrophysics, University of Cape Town (South Africa)). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).
This publication contains only the abstracts of seminars.

20824 **(INIS-mf—11359) Interplanetary matter. Proceedings. Vol. 2.** Ceplecha, Z.; Pecina, P. (eds.). (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. 302p. (CONF-8708269—). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW.

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Of the total number of 57 presented papers 56 have been submitted to INIS. One paper was out of INIS scope. List of sessions (in brackets is the number of papers presented in the respective session and incorporated in the INIS): Preface (2), Comets (17), Asteroids (7), Meteors (19), Interplanetary dust (9), Other bodies (2). (Z.S.). 155 figs., 68 tabs., 1140 refs.

20825 (INIS-mf—11359, pp 1-6) **Review of results on Halley's comet.** Rahe, J. (National Aeronautics and Space Administration, Washington, DC (USA)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Since its recovery in 1982, Halley's comet has been the focus of an unparalleled global scientific effort of exploration. Remote and in-situ measurements were conducted from the ground, from Earth orbit, from Venus orbit, from interplanetary space, and from the comet itself. Many discoveries, such as the presence of an unexpectedly large and dark nucleus or the abundance of organic material, have led to major changes in our ideas about the general nature of comets. Results of various studies are summarized. (author). 5 figs.

20826 (INIS-mf—11359, pp 7-10) **Phobos mission.** Valnicek, B. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The complex space experiment Phobos will consists of two space probes carrying more than twenty experiments each. The primary purpose of the mission, launched in June 1988, is the exploration of the Mars satellite Phobos and of the planet itself. Various methods are used, including landing on the satellite and activation of its surface minerals by laser beam. During orbiting around Mars, the atmosphere of the planet will be studied. The secondary purpose is to study solar activity during the flight from Earth to Mars, gathering informations on solar wind, interplanetary shock waves, and gamma bursts. Solar X-ray activity will be monitored and solar corona observed in X-rays; stereoscopic studies of the Sun will be made. The coordinator of the experiment is the Space Research Institute of the Academy of Sciences of the USSR, the other participants are from Austria, Bulgaria, Czechoslovakia, Finland, France, German Democratic Republic, Federal Republic of Germany, Hungary, Poland, Sweden, Switzerland and ESA. (author). 9 figs.

20827 (INIS-mf—11359, pp 13-20) **Origin and evolution of the Oort cloud.** Napier, W.M. (Royal Observatory, Edinburgh (UK)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Theories of the origin of the Oort cloud are examined in the light of recent observations of comets and of star-forming environments, and some popular hypotheses are found to meet with difficulties. In particular chemical and experimental evidence that comets grow in an extremely cold, quiescent environment is proving difficult to reconcile with recent CO and IR observations showing that the environment of a star-forming region is characterised by turbulent, high-velocity flows and that young stars are prone to recurrent, violent outbursts. The aggregation around young stars of planetesimals pre-existing in molecular clouds avoids these problems. However formed, the Oort cloud is disturbed through interactions with its galactic environment. A record of these past disturbances, episodic or regular, is in principle recoverable through impact cratering and other geological signatures, and these terrestrial records therefore provide a further new constraint on the structure and evolution of the Oort cloud. The concepts of a "dense inner cloud" or a "solar companion star" are difficult to reconcile with the impact cratering history. The debris from the very largest comets are expected to play a dominant role in producing galactic modulations of such fundamental phenomena as the rise and fall of oceans, ice ages, geomagnetic reversals and the origin of life. A {similar←to}15 Myr galactic cycle in particular is predicted. Power spectrum analyses applied to cratering, vulcanism and geomagnetic reversal records for the last {similar←to}200 Myr reveal the presence of a 16+-2 Myr cycle. (author). 8 figs., 79 refs.

20828 (INIS-mf—11359, pp 21-28) **Dynamical evolution of short-period comets.** Carusi, A.; Valsecchi, G.B. (Venice Univ. (Italy)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The dynamical evolution of short-period comets, and in particular of those belonging to the so-called Jupiter family, is reviewed. Encounters with Jupiter play a dominant role in determining the dynamical fate of these objects, although, in some peculiar cases, also interactions with other planets may be important. Frequent although temporary librations around resonances with Jupiter are displayed by more than one third of short-period comets. Integrations of motion of observed comets, over a time span comparable with their lifetime as active objects, are compared with previous numerical investigations, to get insight into the non observed phases of the dynamical evolution of these objects. (author). 5 figs., 8 tabs., 49 refs.

20829 (INIS-mf—11359, pp 29-32) **Long-term resonances and orbital evolutions of Halley-type comets.** Carusi, A.; Valsecchi, G.B.; Kresak, L.; Perozzi, E. (Consiglio Nazionale delle Ricerche, Rome (Italy); Slovenska Akademia Vied, Bratislava (Czechoslovakia); Osservatorio Astronomico Collurania, Teramo (Italy)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Backward integrations of motion of the Halley-type comets, covering over 11,000 years, are used to investigate their librations around high-order resonances with Jupiter. These occur for comets moving in direct orbits with revolution periods between 50 and 90 years. The fact that about one half of them is librating at a time explains the concentration of revolution periods in this range. The librations are of rather uniform period and amplitude, and tend to persist over about 200 revolutions of the comet. Their presence implies that the lifetimes of these comets since their captures into periodic orbits of small perihelion distance mostly exceed 300 revolutions. Possible exceptions among the 9 comets with present periods of 50 to 90 years are the already extinct P/Westphal, and also P/Halley, for which a close approach to the orbit of Jupiter 150 revolutions ago was identified. (author). 2 figs., 1 tab., 10 refs.

20830 (INIS-mf—11359, pp 33-35) **Planetary origin of fireballs and comets.** Padevet, V. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

All known groups of fireballs contain bodies which may reach the Earth's surface as meteorites and are of planetary origin. Since some fireballs have cometary orbits in the Solar System, then comets are probably of planetary origin. The possible explosion of a large planet is discussed again. This time on the basis of gravitationally decelerated expansion of an originally superdense embryo. (author). 2 figs., 15 refs.

20831 (INIS-mf—11359, pp 37-46) **Physical evolution of comets.** Rickman, H. (Uppsala Ionospheric Observatory (Sweden)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Mechanisms currently under consideration for the evolution of cometary nuclei are reviewed. Attention is paid to processes that should have occurred in the past history of observed comets, related to their origin or storage in the Oort cloud, but emphasis is

placed on presently observed evolutionary effects and in particular the late stages characteristic of short-period comets. Evidence from brightnesses and nongravitational forces is discussed and support for a scenario of dust coverage coupled to the evolution of perihelion distance is found. However, for the cases of comets P/Halley and P/Encke where the perihelion distance is unusually small an ultimate fate of complete mass loss or disintegration can not be excluded. (author). 5 figs., 2 tabs., 102 refs.

20832 (INIS-mf—11359, pp 47-50) **Halley dust composition.** Solc, M.; Jessberger, E.K.; Hsiung, P.; Kissel, J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Progress is reported in evaluating the mass spectra of cometary dust grains that have been obtained by impact mass analyzers flown onboard the Giotto and Vega spacecrafts. Statistical analysis of about 5000 spectra transmitted to the Earth in the more compressed modes 1 to 3 demonstrates that the mean elemental composition is similar to that of Cl carbonaceous chondrites with the exception of the light elements C, H, O, and N which approximate solar composition. The isotopic ratios do not differ from solar system values. Five classes of particles are suggested: (1) with dominant Mg-Si element group, (2) with dominant CHON abundances, (3) composites of classes 1 and 2, (4) grains rich in carbon, (5) grains rich in iron and sulphur. (author). 4 figs., 1 tab., 6 refs.

20833 (INIS-mf—11359, pp 51-54) **On the phenomenon of anomalous distribution of metal atom emission in cometary heads.** Ibadov, S. (Institute of Astrophysics, Dushanbe (USSR)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The theory of cometary dust of cooling by a gas outflowing from the nucleus is developed and used for explaining the anomalous distribution of sodium atom emission in the head of comet Mrkos 1957d. The results obtained indicate the universal character of the phenomenon of anomalous distribution of metal atom emissions, including the Na I lines, in the heads of bright comets and the possibility of condensation of a cometary gas (H/sub 2/O, CO/sub 2/ etc.) in the nearnuclear region. (author). 1 fig., 22 refs.

20834 (INIS-mf—11359, pp 55-57) **Laboratory investigation of thermal conductivity of dust crust models on the ice comet nuclei surfaces.** Ibadinov, Kh.I.; Rahmonov, A.A.; Aliev, S.A. (AN Tadzhikskoj SSR, Dushanbe. Inst. Astrofiziki). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

For the purpose of studying the thermal conductivity of comet ice nucleus surfaces dust crust laboratory experiments were carried out on cometary nucleus models. The experiments were carried out under conditions approximating those at heliocentrical distances from 1 to 3 A.U. The ice H/sub 2/O which contained the particles of quartz, graphite, nickel and organic substances DL-alanin, DL-treonin, L-valin was studied. Dust matrices 5 to 15 mm in thickness formed under the ice sublimation irradiated with a light beam. In most cases the effective thermal conductivity of the matrices which included sublimation products diffused in them was one or two orders less than that of H/sub 2/O. (author). 2 figs., 1 tab., 10 refs.

20835 (INIS-mf—11359, pp 59-66) **Are cometary dust mass loss rates deduced from optical emissions reliable?.** Crifo, J.F. (CNRS, LPSP, Verrieres Cedex2 (France)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Additional evidence is presented to support previous works by Crifo in which, from theoretical fits to Comet Halley near- to far- infrared emissions, based on the in-situ flyby probes data, it was estimated that the comet was losing half or more of its mass under the form of large (>1 gram) grains of small (0.3 gcm/sup -3/) density. This confirmed that the comet dust-to-gas mass loss rate ratio lies somewhere between the values 0.80 and 18.6, with a best estimate at 3.46. This result is discussed in the context of the general agreement that comets loose less than half of their total mass loss in dust, and this dominantly at very small grain sizes. This agreement is traced back to overconfidence placed in a model size distribution which inherently excludes substantial mass loss in large grains without appropriate experimental justification. (author). 4 figs., 1 tab., 23 refs.

20836 (INIS-mf—11359, pp 67-69) **Image processing of VEGA-TV observations.** Moehlmann, D. (Institut fuer Kosmosforschung, Berlin (German Democratic Republic)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Methods of processing VEGA-TV observations of the nucleus of P/Halley and derived scientific results are summarized. The existence of lineamentary surface structures is interpreted as an indication for boundary zones between km-sized blocks, building the cometary nucleus. The consequences for cometary origin were investigated. (author). 3 figs., 5 refs.

20837 (INIS-mf—11359, pp 71-73) **Spectral observations of comet Halley (1982 i) in Dushanbe.** Mamadov, O.M. (Institute of Astrophysics, Dushanbe (USSR)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Numerous spectrograms of Halley's comet were taken during October 1985 to May 1986 with the Hissar astronomical observatory 70-cm reflecting telescope AZT-8 and SPM-1 spectrograph giving a dispersion of 160 A/mm. A two cascade image intensifier with fiber optics and Kodak 103 aG emulsion have been used. On the basis of four red and near IR spectra taken on 16 December 1985 with 5 to 40 min exposures a set of provisional identifications shown in the table was given. (author). 1 fig., 1 tab., 5 refs.

20838 (INIS-mf—11359, pp 75-78) **Pre-perihelion photometry of comet Halley at the Skalnate Pleso Observatory.** Svoren, J. (Slovenska Akademia Vied, Skalnate Pleso (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The second part of the pre-perihelion photoelectric measurements of P/Halley obtained at the Skalnate Pleso Observatory is presented. The observations cover 9 nights from November 8, 1985 to January 5, 1986. A set of focal diaphragms of the following diameters was used: 29.53″, 48.98″, 81.08″, 137.34″ and 220.53″. Magnitudes are presented in focal diaphragms in the filters Cont. 365.0 nm, Cont. 484.5 nm, Co/sup +/, C/sub 2/, C/sub 3/ and CN. Coma diameters, photometric parameters and continuum colors are also determined. (author). 11 tabs., 6 refs.

20839 (INIS-mf—11359, pp 79-81) **Spatial distribution of neutral and ionized gas in the Halley comet coma after the perihelion.** Falciani, R.; Tozzi, G.P.; Festou, M.; Smaldone, L.A. (Osservatorio Astrofisico di Arcetri, Florence (Italy); Observatoire de Besancon (France); Naples Univ. (Italy). Ist. di Fisica). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Long slit Halley comet spectra taken at ESO Observatory after the perihelion have been analyzed. Relative intensity radial profiles along and perpendicular to the sun direction have been obtained for CN ($\Delta v=0$), C/sub 2/ ($\Delta v=0$) and C/sub 3/ (4050 A) bands. Interpretation of these profiles with the vectorial model allowed to trace the variability of the gas production rate vs. time

before the observations. It has been shown that the comet increased its gas production rate of a factor 3 on 22.9 March 1986, then it decreased to half the 23.1 March 1986. (author). 5 figs., 1 tab., 8 refs.

20840 (INIS-mf—11359, pp 83-85) **Tail length of comet Halley from historical data.** Esin-Yilmaz, F.; Limboz, F.; Tammann, G.A. (University Observatory, Istanbul (Turkey); Basel Univ. (Switzerland)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

About 200 observations from AD66 to 1910 of the tail length of comet Halley have been used to derive the mean tail length of the comet as visible to the naked eye under very good observing conditions. The curve, covering an interval of -45< or approx. (t-T)< or approx. 80 days, is skewed and peaks at {similar←to}55 million km for (t-T) = 18+-8 days. There is no indication of secular decrease of tail length. (author). 1 fig., 14 refs.

20841 (INIS-mf—11359, pp 87-90) **Plasma tail of comet Bennett 1970 II.** Zvolankova, J.; Kubacek, D.; Pittich, E.M. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

A set of fourteen large-scale exposures of comet Bennett 1970 II between April 27 and 30 1970 is evaluated. Solar wind velocity is determined for this period from the aberration angle of the plasma tail. Its radial component had a minimum value of 70 to 100 km/s in the comet's environment: 50deg off the ecliptic at a distance of 1 AU from the Sun. This value is 3 to 4 times less than the satellite data recorded at the Earth's orbit. The two plasma kinks, visible on 1970 April 30 in the comet tail, moved from the nucleus at a mean radial velocity of 81 and 76 km/s, respectively. No disconnection event appeared in the plasma tail. (author). 3 figs., 3 tabs., 10 refs.

20842 (INIS-mf—11359, pp 91-94) **Production rates of gases and solids in comet P/Halley during the 1986 apparition.** Stecklum, B.; Pfau, W. (2578450DD). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

From photoelectric photometry at 90-cm telescope, continuum and emission band fluxes were derived within the bandpasses of the standard IHW filters. These data were converted to give production rates for CN, C/sub 3/, C/sub 2/, and solids. The observations cover the range of pre-perihelion distances from 2.1 AU to 1.1 AU and include one post-perihelion measurement at 1.7 AU. The production rates of the gaseous components show a strong dependence on heliocentric distance. The result is compared with the behaviour of other comets and theoretical considerations. The dependence is less steep for the solids.This may be due to relatively pronounced backscattering of the grains. During one pre-perihelion night (r=1.5 AU) intensity profiles along three sections through the coma of P/Halley were measured. Compared with the Haser model the profiles show global anisotropy of the coma and possibly local structure. (author). 6 figs., 19 refs.

20843 (INIS-mf—11359, pp 95-97) **Solar corpuscular radiation and outbursts of cometary brightness.** Andrienko, D.A.; Vashchenko, V.N.; Mishchishina, I.I.; Zosimovich, I.D. (Kievskij Gosudarstvennyj Univ. (Ukrainian SSR); AN Ukrainskoj SSR, Kiev). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

A system of integrodifferential equations was established to allow a quantitative estimation to be made of time dependence of icy grain halo brightness after destruction by energy particles of solar wind. The solution led to the assumption that icy grain halo brightness variation is of outburst nature. It was shown that with due account being taken of the contribution of the gas-dust atmosphere the estimated photometric light variation curves are in good agreement with the observed brightness outburst curves. This model takes into consideration the dependence of cometary outburst amplitude and duration on their heliocentric distance and the level of solar corpuscular activity. Also discussed is how visible cometary brightness would be affected by the existence of icy grain halo in cometary atmosphere and the variation of its area owing to fragmentation and sustimation. (Z.S.) 1 fig., 9 refs.

20844 (INIS-mf—11359, pp 101-106) **Collisional evolution of asteroids and asteroid families.** Paolicchi, P.; Zappala, V. (Pisa Univ. (Italy); Osservatorio Astronomico di Torino, Pino Torinese (Italy)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Catastrophic or nearly-catastrophic collisions are the most important physical process affecting the evolution of asteroids following the primordial phases. After a general review of the current ideas about collisional evolution, also in the light of laboratory impact experiments, the problems concerning the interpretation of asteroid families as outcomes of catastrophic processes are discussed. Finally, it is shown how present knowledge of collisional processes (not fully satisfactory) can give important indications of early phases of the evolution of the asteroid belt. (author). 49 refs.

20845 (INIS-mf—11359, pp 107-109) **Asteroid short-periodic perturbations: critical eccentricity and inclination for analytically derived mean semimajor axes.** Knezevic, Z.; Jovanovic, B. (Astronomska Opservatorija, Belgrade (Yugoslavia)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Preliminary results are presented of an attempt to define threshold values of eccentricity and inclination for which a second order - fourth degree analytical theory of asteroid motion still provides mean semimajor axes of acceptable accuracy. (author). 2 figs., 1 tab., 6 refs.

20846 (INIS-mf—11359, pp 111-119) **Physical properties of asteroids.** Farinella, P. (Pisa Univ. (Italy). Ist. di Matematica). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

In the last few decades new observational techniques have provided a wealth of physical information on several hundreds of asteroids. These objects are no longer seen as pointlike bodies mainly interesting as a "dynamical zoo", but have become small "worlds" with known sizes, gross shapes, surface compositions, rotational properties and collisional histories. The diversity of these "worlds" is astonishing: they range in size from less than 1 to 10/ sup 3/ km, in spin period from a few hours to many days, in shape from nearly spherical to very elongated and/or irregular, in surface reflectivity from about 0.02 to 0.4, in composition from metal-rich and silicate rocks to volatile-rich carbonaceous assemblages. There are of course, many peculiar objects: asteroids with surface patches of different brightness and colour; bodies which have suffered internal heating and have developed a core-mantlecrust structure; asteroids converted by catastrophic impacts into gravitationally bound "piles of rubble"; objects with triaxial equilibrium figures or splitted into binary systems; outer-belt asteroids whose spectrophotometric properties are very much alike those of cometary nuclei. Reviewed are some of these recent findings, which are currently being interpreted in the frame of complex theoretical models for the formation and evolution of orbiting and collisionally interacting bodies. (author). 9 figs., 34 refs.

20847 (INIS-mf—11359, pp 121-124) **Effects of non-triaxial shape on the determination of the asteroid spin axis direction via the amplitude-magnitude method.** Cellino, A.; Zappala, V.; Di Martino, M. (Osservatorio Astronomico di Torino, Pino Torinese (Italy)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

At present, the Amplitude-Magnitude (AM) method is largely applied for determining the spin axis direction of asteroids; such a method gives results which in general are in a good agreement with those obtained by means of fundamentally different methods. However, one of the critical assumptions of the AM method is that asteroids are modelled as triaxial ellipsoids with semiaxes a>b>c. Although such an hypothesis appears reasonable for large objects on the basis of physical considerations about their expected equilibrium shapes, very irregular figures are more plausible for smaller objects, probably dominated by solid-state forces. Therefore, it is worth-while to study the influence that deviations from a purely triaxial ellipsoid shape can have on the derived spin axis direction. For this purpose, a numerical program has been developed in order to compute the light curves of irregularly shaped objects at given aspect angles. Some preliminary results are reported concerning the uncertainty of the rotation axis direction of asteroids when non-triaxial shapes are considered. (author). 4 figs., 1 tab., 8 refs.

20848 (INIS-mf—11359, pp 125-129) **Meteoroid streams associated with Apollo asteroids: evidence from the Adelaide radar orbit surveys.** Olsson-Steel, D. (Lund Observatory (Sweden); Adelaide Univ. (Australia)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Since the discovery of Phaethon (the "Geminid asteroid") in 1983 there has been renewed interest in the association of meteor showers with Earth-approaching asteroids. In the past the existence of several streams associated with different asteroids (in particular Adonis, Apollo, Hermes and Oljato) has been suggested but not proven. Here the 3759 meteor orbits determined at Adelaide in the 1960's have been compared to the orbits of all known Aten-Apollo-Amor asteroids using a new and powerful search technique. Strong evidence is found for streams associated with Apollo-type asteroids Icarus, Hermes, Adonis, Oljato, Hephaistos, 5025 P-L, 1982 TA, and 1984 KB; the final five in this list may be members of the Taurid-Arietid complex, as is Comet P/Encke. No stream associated with 1862 Apollo was identified, but this may be due to the lack of observations at the appropriate solar longitude. No streams associated with any Aten or Amor asteroid were found: this may be due to the limited detectability of their meteors, if they exist, because of their low geocentric velocities. In general streams were discovered for all asteroids coming within 0.1 AU of the Earth, having radiants observable from Adelaide and atmospheric velocities above about 22 km/sec: this suggests that meteoroid streams are a general feature of Earth-approaching asteroids. (author). 1 fig., 32 refs.

20849 (INIS-mf—11359, pp 131-132) **Present status of photometric parameters of asteroids.** Kristensen, L.K. (Aarhus Univ. (Denmark). Inst. of Physics). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The external accuracy of photometric parameters of asteroids is investigated by a comparison of published lists. Absolute magnitudes are consistent at the +-0.1 mag level but phase coefficients are still rather uncertain. (author). 1 fig., 1 tab., 5 refs.

20850 (INIS-mf—11359, pp 133-135) **Unusual motion of Amon.** Ziolkowski, K. (Space Research Centre, Warsaw (Poland)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

A precise analysis of the orbit of minor planet (1221) Amor, based on all observations made in 1932 to 1980, shows that in 1956 there was an unexplained event in the motion of the asteroid. Possible interpretations of that fact as well as peculiarities in the long-term motion of Amor in 1650 to 2170 are discussed. The ephemeris of Amor for 1988 is presented. (author). 1 fig., 2 tabs., 4 refs.

20851 (INIS-mf—11359, pp 141-150) **Evolution of meteoroid streams.** Babadzhanov, P.B.; Obrubov, Yu.V. (Institute of Astrophysics, Dushanbe (USSR)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

A meteoroid stream generally considered to be an elliptical ring of relatively small thickness is described. Such shape is attributable to meteoroid streams in an early stage of their evolution. Differences in planetary perturbations influencing the meteoroid particles ejected from the parent body from various points in its orbit at different velocities and time can result in a significant thickening of the stream. Our studies on the evolution of the short-period meteoroid streams have shown that these streams can produce several couples of showers active in different seasons of the year. (author). 5 figs., 7 tabs., 53 res.

20852 (INIS-mf—11359, pp 151-155) **Resonance intermittance causes the gravitational splitting of meteor streams.** Froeschle, C.; Scholl, H. (Observatoire de Nice, 06 (France); Astronomisches Rechen-Institut, Heidelberg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The dynamical evolution of meteor stream particles in resonance appears to be affected by the same resonance mechanisms as resonant asteroids. Crossing of separatrix like zones appears to be crucial for the formation of arcs and for the dissolution of streams. Examples of such a transitory arc formation were found in the investigation of the orbital evolution of known resonant meteor streams and of model streams. The orbital inclination of a meteor stream appears to be a critical parameter for arc formation. (author). 3 figs., 11 refs.

20853 (INIS-mf—11359, pp 157-161) **Dispersal of meteoroid streams by radiative effects.** Olsson-Steel, D. (Lund Observatory (Sweden); Adelaide Univ. (Australia)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

A major problem in meteor astronomy is why the orbits of meteoroids within particular streams are so dispersed. For streams with aphelia well within Jupiter (such as the Geminids) planetary perturbations cause insignificant dispersion but can accommodate the required motion of the nodal heliocentric distance to explain why the Geminids were not observed prior to the 1860's. The spread in the orbits would also require unreasonably large ejection velocities from the parent. Another dispersal mechanism is therefore required. By incorporating perturbations due to the Yarkovsky-Radzievskii effect into the model the Geminid dispersal can be understood; by including also the effects of the radiation pressure and Poynting-Robertson forces the main observed characteristics of the stream (shower duration variation with magnitude; skew rate profile; changes in mass distribution and radiant diffuseness as the shower progresses) are explicable. The necessary spin rates (about 3000 rev/sec for 1 mm and 1000 rev/sec for 1 cm radius meteoroids) would be attained within a thousand years of release from the parent body, due to spin-up under solar radiation pressure. It therefore appears that the Yarkovsky-Radzievskii effect is an important source of stream dispersion which has been hitherto neglected, but should be included in future models. (author). 1 fig., 37 refs.

20854 (INIS-mf—11359, pp 163-166) **On applicability of meteor stream membership criteria.** Stohl, J.; Porubcan, V. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Meteor stream membership criteria used for evaluating potential associations between individual meteor orbits and the mean orbit of a stream are discussed on the basis of precise photographic orbits of some meteor streams (the Taurids, Geminids and Perseids). Serious shortcomings of the D-criterion are disclosed and suggestions of a more relevant use of the criteria for estimating stream memberships are presented, with attention paid to the distributions of the orbital elements of the streams. (author). 2 figs., 17 refs.

20855 (INIS-mf—11359, pp 167-171) **Meteor complex of P/Encke.** Porubcan, V.; Stohl, J. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The Taurid meteor complex associated with P/Encke is studied on the basis of relevant photographic and radar orbits. Orbital characteristics, radiants and durations of the postperihelion showers are compared with corresponding theoretical values derived from the observations of the preperihelion Taurids. Reality of the proposed associations of minor showers with the Taurid complex and the total duration of its activity are evaluated and discussed. Some of the associated showers (the Northern and Southern chi Orionids, Northern Piscids and Southern Arietids) are confirmed to be in fact parts of the Taurid shower itself. (author). 3 figs., 5 tabs., 23 refs.

20856 (INIS-mf—11359, pp 173-175) **Particle density variations along the orbit of the Halley meteor stream.** Hajdukova, M. (Komenskeho Univ., Bratislava (Czechoslovakia). Prirodovedecka Fakulta). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Mechanisms leading to higher particle concentrations in several places along the meteor stream associated with Halley are discussed. The positions of the mass concentrations represented by the mean anomaly of the stream orbit, as determined from long series of observations of the Orionids and Eta Aquarids, are correlated with the deviations in the semi-major axis and nodes of the evolving orbit of the comet. It is shown that random deviations in the orbital elements of the comet may be responsible for the nonstable mass concentrations in the stream. (author). 4 figs., 14 refs.

20857 (INIS-mf—11359, pp 177-178) **Dust production of comet Halley with account of large particle contribution.** Hajduk, A. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Critical analysis of the results of space experiments, taking into account the contribution of large particles to the total mass production of comet Halley leads to much higher values of the dust production rate than those derived from the first analysis of space measurements. It thereby seems necessary to correct the gas-to-dust ratio of the mass production by a factor of 10, from 0.1-1.0 to 1.0-10. The corrected values of dust production rate are in much better agreement with both the current concepts of the comet's history and with the evolution of its meteor stream. (author). 20 refs.

20858 (INIS-mf—11359, pp 179-182) **Activity of the meteoric complex of comet Halley.** Cevolani, G.; Hajduk, A. (Consiglio Nazionale delle Ricerche, Bologna (Italy); Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Results of radar observations of the Orionid and Eta Aquarid meteor showers carried out in Budrio (Italy) within the IHW program were compared with simultaneous data from Ondrejov (Czechoslovakia). The activity of these showers was studied in relation to the motion of large particles ejected from the comet. The activity was found to be independent on the approach of the parent comet. (author). 5 figs., 1 tab., 11 refs.

20859 (INIS-mf—11359, pp 183-187) **Meteor physics.** Pecina, P. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Problems are discussed related to the knowledge and understanding of events observable during meteoroid flight through the atmosphere. The survey is divided into three parts. The first part deals with the section of flight characterized by the increase of body temperature at the heliocentric distance 1 AU, i.e. at the frontier of the Earth's atmosphere, which was estimated to be approximately 280deg K, to the temperature at which meteoroid evaporation can start. This process is described as pre-ablation heating. The second part deals with effects connected with the visible trajectory and with ionization trails and problems related to them. There exists a generic connection between the luminous flight and dark flight of meteoroids and the predictability of the impact area and the impact itself of fallen meteoroids. This is the subject of part three of the survey. (author). 49 refs.

20860 (INIS-mf—11359, pp 189-191) **On the light pulsation of bright Geminids according to photographic data.** Babadzhanov, P.B.; Konovalova, N.A. (Institute of Astrophysics, Dushanbe (USSR)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The photometric light curves of bright Geminids are investigated. The analysis of the light curves reveals a peculiar nature of meteor luminosity with rapid flickering and small brightness fluctuations. This peculiarity of the luminosity of the bright Geminids points to a certain ablation of these meteoroids in the Earth's atmosphere. From estimates of the ablation energy it was concluded that the investigated Geminid meteoroids were disrupted in the atmosphere by the melting and cyclic ablation of the surface-layer of meteoric matter. (author). 2 figs., 2 tabs., 7 refs.

20861 (INIS-mf—11359, pp 193-197) **Frue height distribution and flux of radar meteors.** Olsson-Steel, D.; Elford, W.G. (Lund Observatory (Sweden); Adelaide Univ. (Australia)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

When compared to satellite detector measurements of dust particles of mass $<10/sup -6/$ g and optical meteor observations for mass $>10/sup -2/$ g, the flux of the interstitial radar meteors is discrepant: the radars render fluxes which seem too small by a factor of about 20 to 30. This has usually been explained as being due to the majority of the flux being held in low-velocity meteors which produce little ionization and hence have limited radar detectabilities. An alternative hypothesis is proposed: that the discrepancy is due to wavelength-dependent effects, implying that conventional meteor radars ($f>20$ MHz) only detect the lower-altitude underdense meteors. To test this the height distribution was determined of radar meteors at 2 and 6 MHz, at which frequencies the

echo ceilings are much higher than the 100 to 105 km limits of VHF radars. The distribution peak was found at {similar←to}105 km, fully 10 km above the peaks of VHF radars, with many meteors occurring to at least 140 km altitude. Additional observations using the powerful Jindalee radar incentral Australia confirm these results, and show that the cumulative flux of particles of mass >10/sup -6/ g is about 9x10/sup -8/ m/sup -2/ sec/sup -1/; this is consistent with satellite data and is over an order of magnitude larger than derived in previous radar meteor experiments. (author). 3 figs., 23 refs.

20862 (INIS-mf—11359, pp 199-200) **Mass distribution of underdense meteor echoes: selection of basic data.** Simek, M. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The volume of recorded underdense meteor echoes is determined by transmitted power, treshold sensitivity of the receiver, antenna gain including its directivity and by the range of reflecting point on the meteor trail. These parameters must be considered when mass distribution index is evaluated. (author). 1 fig., 5 refs.

20863 (INIS-mf—11359, pp 201-204) **IAU meteor data center in Lund.** Lindblad, B.A. (Lund Observatory (Sweden)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The purpose of the IAU Meteor Data Center in Lund is to archive information on meteoroid orbits. At present some 5000 photographic double-station orbits and more than 60,000 radio determined orbits are archived. The available data are described and some problems discussed encountered in the archiving process. (author). 2 tabs., 29 refs.

20864 (INIS-mf—11359, pp 205-209) **Meteoroid deceleration and the Fresnel characteristics.** Pecina, P. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The application is briefly described of the complete solution of the basic equations of meteoric physics, found during a study of photographic meteor theory, to the construction of theoretical Fresnel characteristics. It is shown how meteoroid deceleration can be incorporated in concepts of radar physics. The corresponding equations are derived and the possibility of using these Fresnel characteristics for the evaluation of ablation parameter σ and preatmospheric velocity v/sub ∞/ from the registered amplitudes is briefly discussed. (author). 11 refs.

20865 (INIS-mf—11359, pp 211-215) **Numbers and masses of different populations of sporadic meteoroids from photographic and television records.** Ceplecha, Z. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Double and multistation data on meteors from photographic and television records are used, to derive relative and absolute numbers of sporadic meteoroids coming to the Earth's vicinity and their mass accession. Seven different meteoroid populations are dealt with separately inside a mass interval of 2x10/sup 7/ g to 2x10/sup -5/ g and their cumulative numbers with decreasing mass determined. The paper is an abstract of a more extensive paper, which will be published in Bull. Astron. Inst. Czechosl. in 1988. (author). 2 figs., 3 tabs., 20 refs.

20866 (INIS-mf—11359, pp 217-220) **On the interaction meteor complex.** Rajchl, J. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

An approach to the problem of a meteoric complex called the Interaction Meteor Complex (IMC) is applied and discussed, and the author's former idea of the interaction layer (Rajchl 1969) is generalized. The role of an extended interaction of meteoroids is ephasized, both with planet surfaces and/or their satellites and with planet atmospheres, elastic or inelastic in form. The dissipation and related formative aspect are linked in one complex and compared with a topological compact. Examples of all the above mentioned types of interaction are presented. The inelastic interaction with the Earth atmosphere of whole "spectrum" from faint meteors detected by TV technique to Fireball Network bolides is considered in more detail. First results in the form of a psi structure and cross-complementarity are reported. The possibility of the existence of another "enlarged" psi structure is anticipated with regard to topological aspects and supported for the outer planets of the Solar Planetary System by results of Levin and Simonenko (1982). (author). 1 fig., 2 tabs., 11 refs.

20867 (INIS-mf—11359, pp 221-222) **Separation of the particles during meteor flares.** Getman, V.S. (Institute of Astrophysics, Dushanbe (USSR)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The method of estimating the numbers of fragments into which meteor bodies fragment during the terminal flares is offered. (author). 1 fig., 1 tab., 10 refs.

20868 (INIS-mf—11359, pp 223-224) **Photographic data of extreme precision evaluated by exact single-body solution of meteor physics.** Babadzhanov, P.B.; Ceplecha, Z. (Institute of Astrophysics, Dushanbe (USSR); Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The exact solution of the single-body motion and ablation of a meteoroid in the atmosphere is applied to one of the most precise double-station records of a fireball photographed from Dushanbe Oct 30, 1962. The entire trajectory of 5.2 seconds duration from 77 km to 36 km of height with 258 time marks corresponds to a single value of the ablation coefficient. (author). 3 refs.

20869 (INIS-mf—11359, pp 225-227) **Some new aspects in the positional reduction of the photographs taken by fish-eye objectives.** Spurny, P. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The method used up hitherto for positional reductions of photographs is compared with other reductional formulas. It was found that the reduction formula presently used for determination of the zenith distance is suitable while the formula for determining the azimuth can be replaced by a new expression which essentially improves the total positional reduction. (author). 3 tabs., 1 ref.

20870 (INIS-mf—11359, pp 231-239) **Distribution of interplanetary dust.** Giese, R.H.; Kneissel, B. (Bochum Univ. (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Simple 3D distributions of the interplanetary dust cloud derived from observations in the visible and distributions suggested by

IR investigators are compared. Predictions of visual brightness based on IR models are fairly compatible with observations for large ($\epsilon < 70$deg) elongations but not close to the Sun. Some reasons for this behaviour and first steps towards more realistic models are discussed. (author). 4 figs., 1 tab., 39 refs.

20871 (INIS-mf—11359, pp 241-244) **Dynamics of the zodiacal dust cloud on account of optical and infrared observations.** Kneissel, B.; Giese, R.H. (Bochum Univ. (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The method for determining inclination distribution of zodiacal particle orbits according to 3D- density models of zodiacal dust presented by Giese and Kneissel (1987, this volume) is briefly discussed. The results show that models with additional bulges at the solar poles bear an istropic component of the inclination distribution amounting up to 20% of all orbits, whereas infrared models show almost no isotropic component. The existence of an isotropic component for zodiacal dust orbits is questioned by a comparison with the orbital elements of meteoroidal particles which are a source of zodiacal dust from mutual collisions. (author). 36 refs.

20872 (INIS-mf—11359, pp 245-248) **Proton microprobe analysis of interplanetary dust particles.** Wallenwein, R.; Antz, Ch.; Jessberger, E.K.; Traxel, K. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

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Comets and asteroids are thought to be the main sources of interplanetary dust particles (IDPs). IDPs with a diameter <50 μm are able to survive the entry into the Earth's atmosphere, where they can be collected without destruction. Because of their small size and mass, typically <10 μm and $<10/\text{sup } -9/$ g, their chemical analysis is difficult. The proton microprobe is introduced for the nondestructive detection of trace elements in interplanetary dust particles (IDP). Using the Heidelberg proton microprobe which provides a beam spot of $<2x3$ μm/sup 2/, four IDPs have been analyzed and up to 26 elements were detected. To quantitatively evaluate the proton-induced X-ray spectra we calculated ab initio X-ray yields for the samples. Most elemental abundance ratios in three IDPs agree within a factor of two with those of cosmic abundance with the notable exception of some volatile elements (P, Cu, Ga, Br, and Zn) which are strongly enriched. This is in contrast with one IDP in which Ca and the volatile elements K, Zn and S are depleted. (author). 3 figs., 1 tab., 18 refs.

20873 (INIS-mf—11359, pp 249-252) **Chemical analysis of interplanetary dust particles with synchrotron radiation.** Antz, Ch.; Jessberger, E.K.; Wallenwein, R.; Bavdaz, M.; Knoechel, A. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Inst. fuer Anorganische und Angewandte Chemie). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

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Two 10-μm interplanetary dust particles collected in the stratosphere, were analyzed with X-ray fluorescence excited by white synchrotron radiation (SYXFA) at the HASYLAB (DESY) in Hamburg. The measured abundances of the minor and trace elements with $16<Z<76$ are in good agreement with abundances determined by PIXE analysis of the same particles. The results demonstrate that SYXFA is indeed a powerful nondestructive technique for multi-element analysis of micron-sized samples. Moreover the combined application of two such techniques, SYXFA and PIXE, to the same valuable particle has been found to lend high credibility to the results. (author). 5 figs., 14 refs.

20874 (INIS-mf—11359, pp 253-255) **On the source and structure of interplanetary dust particles.** Fechtig, H. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

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Cometary dust grains measured by the Halley space missions show a silicate- and a light element component. The latter most likely represents an organic material. Grain density is mostly below 1 g/cm/sup 3/. The organic component slowly decays at higher temperatures during subsequent perihelion passages. Therefore "older" cometary grains differ from the "young" cometary grains: they show higher albedos, higher densities and orbit finally within the inner solar system. (author). 19 refs.

20875 (INIS-mf—11359, pp 257-263) **Dynamics of interplanetary dust.** Gruen, E. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Gravitation, solar radiation pressure and Lorentz force are the dominant forces determining the motion of interplanetary particulates. The latter two becoming significant for micron- and submicron- sized particles. In situ measurements by spaceprobes, microcrater distributions and remote observations both in the IR and visible wavelength range have established the mass frequency and spatial distribution of dust particles in interplanetary space. Consequences of the Poynting-Robertson effect and mutual collisions for these distributions and the contributions of various sources (interstellar dust, asteroids and comets) are discussed. It is shown that the contribution from a distributed source of large particles in the inner solar system is most important. Collisions between these meteor sized particles ($m>10/\text{sup } -5/$ g) produce large amounts of zodiacal light particles ($10/\text{sup } -10/$ g to $10/\text{sup } -5/$ g) and β-meteoroids ($m<10/\text{sup } -10/$ g) which leave the solar system on hyperbolic orbits. At present the Poynting-Robertson effect transports into the inner solar system less than 10% of the zodiacal light particles which are produced by collisions from bigger particles. (author). 4 figs., 41 refs.

20876 (INIS-mf—11359, pp 265-271) **Contribution of periodic comets to the zodiacal cloud.** Kresak, L.; Kresakova, M. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The dust production rates of all known periodic comets, calibrated by the measurement of the 1986 apparition of comet Halley, are used for calculating their dust ejections into the earth orbit and the resulting dust fluxes at $R=1$ AU. The spatial distribution of the fresh ejecta and the temporal variations of their accumulation are reconstructed. The visible release of dust is evidently insufficient to maintain the zodiacal cloud in equilibrium. It is suggested that the progressive decay of dark matter, including extinct cometary nuclei, their fragments and products of asteroidal collisions is the dominant source of the replenishment of the interplanetary dust complex. (author). 3 figs., 2 tabs., 18 refs.

20877 (INIS-mf—11359, pp 273-275) **Evolution equations for interplanetary dust.** Banaszkiewicz, M.; Kapisinsky, I. (Polska Akademia Nauk, Warsaw; Slovenska Akademia Vied, Bratislava (Czechoslovakia). Astronomicky Ustav). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Kinetic equations are formulated for the distribution function of dust particles in mass and in element spaces. Erosive as well as catastrophic collisions are taken into account. Sputtering is also included and radiative effects are considered. Initial conditions are derived from the Interplanetary Flux Model for mass distribution, and fan or cosine models for spatial density. (author). 2 figs., 8 refs.

20878 (INIS-mf—11359, pp 281-284) **Symmetry plane of the zodiacal cloud retrieved from IRAS data.** Dumont, R.; Levasseur-Regourd, A.C. (Observatoire de Bordeaux, 33 - Floirac (France); Centre National de la Recherche Scientifique, 91 - Verrieres-le-Buisson (France). Service d'Aeronomie). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Annual oscillations of brightnesses observed at 12 and 25 μm by IRAS near the ecliptic poles are mainly due to the inclination of the symmetry plane (SP) of the interplanetary dust cloud upon the ecliptic; also, secondarily, due to the eccentricity of the earth's orbit. Comparing brightnesses at the poles and in the ecliptic (near 90deg elongation) allows to retrieve inclination i and ascending node Ω SP/ecliptic through an inversion technique, with very little model-dependence. The results (i=1.5deg, Ω=90deg) conflict with some of those previously obtained from the same observations by more model-dependent approaches, they do, however, agree with former optical determinations from the D2A satellite and from Tenerife ground-based data. (author). 6 figs., 27 refs.

20879 (INIS-mf—11359, pp 287-290) **Probable periodicities of the Jovian atmospheric activity.** Xanthakis, J.; Petropoulos, B.; Banos, L. (Academy of Athens (Greece); Astronomical Institute, National Observatory of Athens (Greece)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

Coefficient of activity "R" was introduced for measuring the activity of the atmosphere of the planet Jupiter. The coefficient was obtained by photommetric analysis of photographic plates and is defined by the relation: R=1/C∫ /sub -45deg//sup +45deg/(1-I(phi))dphi where R is the photometric coefficient of activity, phi is zenographical latitude, C is the constant reference area with limits +-45deg. I(phi) - B/sub s//B/sub c/ is the ratio of intensities B/sub s/ of a point on the polar diameter B/sub c/ of the brightest points with limits 0 to 1. Using data obtained in observations and their analytical processing, the following periods were found for the coefficient of the atmospheric activity of the planet Jupiter: 1/22 years for the time interval 1914 to 1986; small periodicities of 4 and 8 years, respectively. (Z.S.) 2 figs., 2 tabs., 23 refs.

20880 (INIS-mf—11359, pp 291-294) **Reference model for the atmosphere of Titan.** Petropoulos, B.; Georgakilas, A.A. (Academy of Athens (Greece)). 1987. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88706057/JAW. (CONF-8708269—).

From 10. European regional astronomy meeting of the IAU; Prague, Czechoslovakia (24 Aug 1987).

The following physical parameters were calculated for the atmosphere of Titan, using Voyager's measurements: (1) Temperature, (2) Pressure, (3) Density, (4) Speed of sound, (5) Density scale, (6) Number density, (7) Mean free path, (8) Viscosity, (9) Pressure scale, (10) Mean particle velocity, (11) Mean collisional frequency, (12) Columnar mass. (author). 12 figs., 2 tabs., 18 refs.

20881 (LA-UR—89-280) **A novel approach to gamma-ray and neutrino astro-particle physics: The GRANDE experiment.** Haines, T.; Adams, A.; Bond, R.; Bratton, C.B.; Chaloupka, V.; Cherry, M.; Coleman, L.; Ellsworth, R.; Gaidos, J.; Goodman, J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881268—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006515/JAW.

From 14. Texas symposium on relativistic astrophysics; Dallas, TX, USA (11 Dec 1988).

The GRANDE experiment is a unique "next-generation" detector capable of making significant contributions to the fields of ν and γ-ray astrophysics as well as performing important "conventional" high-energy physics investigations. The detector, which covers an area of 250 m {times} 250 m, is based on the well proven water Cerenkov technique. It will have excellent coverage for potential sources of ν emission in the southern hemisphere and of VHE and UHE sources in the northern hemisphere. For VHE and UHE showers, the low threshold (≦10 TeV) and complete coverage for all three shower components (electromagnetic, muonic, and hadronic), are unique. Excellent angular resolution, <1{degree} for ν's and <0.3{degree} for γ-rays, large acceptance, good energy resolution, and wide energy sensitivity will permit detailed studies of the observed signals enabling a quantitative confrontation with theoretical predictions. The detector and some of its physics capabilities will be described. 4 refs., 7 figs.

20882 (LA-UR—89-494) **Observations and predictions of EUV emission from classical novae.** Starrfield, S.; Truran, J.W.; Sparks, W.M.; Krautter, J. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 19p. (CONF-890189—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007984/JAW.

From Berkeley colloquium on extreme ultraviolet astronomy; Berkeley, CA, USA (19 Jan 1989).

Theoretical modeling of novae in outburst predicts that they should be active emitters of radiation both in the EUV and soft X-ray wavelengths twice during the outburst. The first time is very early in the outburst when only an all sky survey can detect them. This period lasts only a few hours. They again become bright EUV and soft X-ray emitters late in the outburst when the remnant object becomes very hot and is still luminous. The predictions imply both that a nova can remain very hot for months to years and that the peak temperature at this time strongly depends upon the mass of the white dwarf. It is important to observe novae at these late times because a measurement of both the flux and temperature can provide information about the mass of the white dwarf, the tun-off time scale, and the energy budget of the outburst. We review the existing observations of novae in late stages of their outburst and present some newly obtained data for GQ Mus 1983. We then provide results of new hydrodynamic simulations of novae in outburst and compare the predictions to the observations. 43 refs., 6 figs.

20883 (N—89-14053) **General formalism for phase space calculations.** Norbury, J.W.; Deutchman, P.A.; Townsend, L.W.; Cucinotta, F.A. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Nov 1988. 23p. (NASA-TP—2843; L—16463; NAS—1.60:2843). NTIS, PC A03/MF A01.

General formulas for calculating the interactions of galactic cosmic rays with target nuclei are presented. Methods for calculating the appropriate normalization volume elements and phase space factors are presented. Particular emphasis is placed on obtaining correct phase space factors for 2-, and 3-body final states. Calculations for both Lorentz-invariant and noninvariant phase space are presented.

20884 (N—89-14187) **Environment of Mars, 1988.** Kaplan, D.I. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). Oct 1988. 71p. (NASA-TM—100470; S—587; NAS—1.15:100470). NTIS, PC A04/MF A01.

A compilation of scientific knowledge about the planet Mars is provided. Information is divided into three categories: atmospheric data, surface data, and astrodynamic data. The discussion of atmospheric data includes the presentation of nine different models of the Mars atmosphere. Also discussed are Martian atmospheric constituents, winds, clouds, and solar irradiance. The great dust storms of Mars are presented. The section on Mars surface data provides an in-depth examination of the physical and chemical properties observed at the two Viking landing sites. Bulk densities, dielectric constants, and thermal inertias across the planet are then described and related back to those specific features found at the Viking landing sites. The astrodynamic materials provide the astronomical constants, time scales, and reference coordinate frames necessary to perform flightpath analysis, navigation design, and science observation design.

20885 **(N—89-14193) Ultraviolet observations of selected astronomical sources. Final technical report, 1 July 1986-31 August 1988.** Halpern, J.P. (Columbia Univ., New York (USA)). Dec 1988. 27p. (NASA-CR—184585; NAS—1.26:184585; CAL—1732). NTIS, PC A03/MF A01.

The results of the 9th and 10th IUE episode programs listed are summarized. Observations and basic data reductions were completed for 4 extragalactic programs which were allocated a total of 9 US1 shifts, and 2 stellar investigations which used 10 US2 shifts. Use was made of the Goddard RDAF to obtain better signal to noise ratio spectra using the Gaussian extraction routines. Highlights include the first IUE observations of H1821+643, the second brightest quasar in the sky, and the discovery of accretion disk emission line profiles in the elliptical Seyfert galaxy Arp 102B. Both of these observations were accompanied by nearly simultaneous optical spectrophotometry. As a result of the stellar programs, large amplitude variability associated with the rotation period of the Ap stars 78 Vir and 53 Cam was found.

20886 **(N—89-14194) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 1: Explanatory supplement.** Beichman, C.A.; Neugebauer, G.; Habing, H.J.; Clegg, P.E.; Chester, T.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 455p. (NASA-RP—1190-VOL-1; NAS—1.61:1190-VOL-1). NTIS, PC A20/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched on January 26, 1983. During its 300-day mission, IRAS surveyed over 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. Volume 1 describes the instrument, the mission, and data reduction.

20887 **(N—89-14195) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 5: The point source catalog declination range -30 deg greater than delta greater than -50 deg.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 410p. (NASA-RP—1190-VOL-5; NAS—1.61:1190-VOL-5). NTIS, PC A18/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched January 26, 1983. During its 300-day mission, IRAS surveyed over 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. This is Volume 5, The Point Source Catalog Declination Range -30 deg greater than delta greater than -50 deg.

20888 **(N—89-14196) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 4: The point source catalog declination range 0 deg greater than delta greater than -30 deg.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 596p. (NASA-RP—1190-VOL-4; NAS—1.61:1190-VOL-4). NTIS, PC A25/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched 26 January 1983. During its 300-day mission, it surveyed over 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. This is Volume 4, The Point Source Catalog Declination Range 0 deg greater than delta greater than -30 deg.

20889 **(N—89-14197) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 2: The point source catalog declination range 90 deg greater than delta greater than 30 deg.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 555p. (NASA-RP—1190-VOL-2; NAS—1.61:1190-VOL-2). NTIS, PC A24/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched January 26, 1983. During its 300-day mission, IRAS surveyed 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. This is Volume 2, The Point Source Catalog Declination Range 90 deg greater than delta greater than 30 deg.

20890 **(N—89-14198) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 6: The point source catalog declination range -50 deg greater than delta greater than -90 deg.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 473p. (NASA-RP—1190-VOL-6; NAS—1.61:1190-VOL-6). NTIS, PC A20/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched January 26, 1983. During its 300-day mission, it surveyed over 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. This is Volume 6, The Point Source Catalog Declination Range -50 deg greater than delta greater than -90 deg.

20891 **(N—89-14199) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 7: The small scale structure catalog.** Helou, G.; Walker, D.W. (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 348p. (NASA-RP—1190-VOL-7; NAS—1.61:1190-VOL-7). NTIS, PC A15/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched January 26, 1983. During its 300-day mission, it surveyed over 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. Volume 1 describes the instrument, the mission, and the data reduction process. Volumes 2 through 6 present the observations of the approximately 245,000 individual point sources detected by IRAS; each volume gives sources within a specified range of declination. Volume 7 gives the observations of the approximately 16,000 sources spatially resolved by IRAS and smaller than 8′. This is Volume 7, The Small Scale Structure Catalog.

20892 **(N—89-14201) Infrared astronomical satellite (IRAS) catalogs and atlases. Volume 3: The point source catalog declination range 30 deg greater than delta greater than 0 deg.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1988. 493p. (NASA-RP—1190-VOL-3; NAS—1.61:1190-VOL-3). NTIS, PC A21/MF A01; also available SOD.

The Infrared Astronomical Satellite (IRAS) was launched January 26, 1983. During its 300-day mission, IRAS surveyed over 96 pct of the celestial sphere at four infrared wavelengths, centered approximately at 12, 25, 60, and 100 microns. This is Volume 3, The Point Source Catalog Declination Range 30 deg greater than delta greater than 0 deg.

20893 **(N—89-14204) Ionization structure of planetary nebulae. 9: NGC 1535.** Barker, T. (Wheaton Coll., IL (USA)). 1988. 32p. (NASA-CR—184566; NAS—1.26:184566). NTIS, PC A03/MF A01.

Spectrophotometric observations of emission-line intensities over the spectral range 1400 to 7200 A were made in five positions in the planetary nebula NGC 1535. There is some evidence for variation in the Balmer decrements between these positions. The O(++) electron temperature varies little from 11500 K across these positions; the Balmer continuum electron temperature averages a few hundred K higher than this, but this difference is insignificant when compared to the measurement errors. As found for most of the other planetaries in this series, the wavelength 4267 C II line intensity near the central star implies a C(++) abundance that is several times higher that that determined from the wavelength 1906, 1909 C III lines. The discrepancy again decreases with increasing distance from the central star, again suggesting that the excitation mechanism for the wavelength 4267 C II is not understood. Standard equations used to correct for the existence of elements in other than the optically observable ionization stages give consistent results for the different positions; there is no evidence for any abundance gradient in the nebula. The logarithmic abundances are He = 10.99, O = 8.51, N = 7.63, Ne = 7.89, C = 8.34, and Ar = 6.08. The abundances agree well with determinations by Aller and Czyzak and by Torres-Peimbert and Peimbert and are nearly identical to those found for NGC 6826. As for NGC 6826, the rather low abundances of He, N, and C suggest that there was little if any mixing of CNO-processed material into the nebular shell in the progenitor to NGC 1535. The O, Ne, Ar abundances appear to be somewhat low, suggesting that the progenitor to NGC 1535 may have formed out of somewhat metal-poor material.

20894 (N—89-14825) **Evolution of photon and particle spectra in compact, luminous objects. Final report, August 1985-September 1988.** Eilek, J.A.; Caroff, L.J.; Noerdlinger, P.D. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Nov 1988. 11p. (NASA-TM—101247; NAS—1.15:101247). NTIS, PC A03/MF A01.

The physics of high energy photons and particles (especially electrons and positrons) in the compact, high-energy-density of galactic nuclei and quasars was investigated. A numerical code was developed which follows the nonlinear spectral evolution of a pair/photon plasma, due to two-body scattering and interaction process, in an unmagnetized system. The code was applied both to static plasmas and to relativistic expanding winds.

20895 (N—89-14998) **Experiments in Planetary and Related Sciences and the Space Station.** Greeley, R.; Williams, R.J. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). Nov 1987. 188p. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—). NTIS, PC A09/MF A01.

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

Numerous workshops were held to provide a forum for discussing the full range of possible experiments, their science rationale, and the requirements on the Space Station, should such experiments eventually be flown. During the workshops, subgroups met to discuss areas of common interest. Summaries of each group and abstracts of contributed papers as they developed from a workshop on September 15 to 16, 1986, are included. Topics addressed include: planetary impact experimentation; physics of windblown particles; particle formation and interaction; experimental cosmochemistry in the space station; and an overview of the program to place advanced automation and robotics on the space station.

20896 (N—89-14998, pp 4) **Particle formation and interaction.** Squyres, S.; Corso, G.J.; Griffiths, L.D.; Mackinnon, I.D.R.; Marshall, J.R.; Nuth, J.A. III; Werner, B.; Wolfe, J. (San Jose State Univ., CA (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

A wide variety of experiments can be conducted on the Space Station that involve the physics of small particles of planetary significance. Processes of interest include nucleation and condensation of particles from a gas, aggregation of small particles into larger ones, and low velocity collisions of particles. All of these processes could be investigated with a general purpose facility on the Space Station. The microgravity environment would be necessary to perform many experiments, as they generally require that particles be suspended for periods substantially longer than are practical at 1 g. Only experiments relevant to planetary processes will be discussed in detail here, but it is important to stress that a particle facility will be useful to a wide variety of scientific disciplines, and can be used to address many scientific problems.

20897 (N—89-14998, pp 4) **Experimental cosmochemistry in the Space Station.** Duba, A. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The purpose of two workshops was to identify and discuss experiments in cosmochemistry that cannot be conducted under the conditions available in terrestrial laboratories, but may be carried out successfully in the proposed Space Station. The scientific discussions focused on two general areas of research: chemical and physical processes in the earliest history of the general areas of research, and general principles of magmatic process applicable both to planetary formation and evolution, as well as present-day magmatic activity in and on terrestrial planets.

20898 (N—89-14998, pp 2) **Cosmic dust collection with a sub satellite tethered to a Space Station.** Corso, G.J. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The number concentration and density of 1 micron and submicron sized grains in interplanetary space, as well as their relation to the larger zodical dust particles, and the importance of the beta meteoroid phenomenon are currently being questioned. The best approach to collecting large numbers of intact micron and submicron sized cosmic dust particles in real time while avoiding terrestrial and man made contamination would be to employ a tethered subsatellite from a space station down into the earth's atmosphere. Such a subsatellite tied to the space shuttle by a 100 km long tether is being developed. It is also possible that a permanent space station would allow the use of a tether even longer than 100 km. It should be noted that the same tethered collectors could also be employed to study the composition and flux of man made earth orbiting debris in any direction within 100 km or so of the space station.

20899 (N—89-14998, pp 3) **Electrical conductivity of carbonaceous chondrites and electric heating of meteorite parent bodies.** Duba, A. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

Electromagnetic heating of rock-forming materials most probably was an important process in the early history of the solar system. Electrical conductivity experiments of representative materials such as carbonaceous chondrites are necessary to obtain data for use in electromagnetic heating models. With the assumption that carbon was present at grain boundaries in the material that comprised the meteorite parent bodies, the electrical heating of such bodies was calculated as a function of body size and solar distance using the T-Tauri model of Sonett and Herbert (1977). The results are discussed.

20900 (N—89-14998, pp 2) **Electrical conductivity of chondritic meteorites.** Duba, A.; Didwall, E.M.; Burke, G.J.; Sonett, C.P. (Arizona Univ., Tucson (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The electrical conductivity of samples of the Murchison and Allende carbonaceous chondrites is 4 to 6 orders of magnitude greater than rock forming minerals such as olivine for temperatures up to 700 C. The remarkably high electrical conductivity of these meteorites is attributed to carbon at the grain boundaries. Much of this carbon is produced by pyrolyzation of hydrocarbons at temperatures in excess of 150 C. As the temperature increases, light hydrocarbons are driven off and a carbon-rich residue or char migrates to the grain boundaries enhancing electrical conductivity. Assuming that carbon was present at the grain boundaries in the material which comprised the meteorite parent bodies, the electrical heating of such bodies was calculated as a function of body size and solar distance during a hypothetical T-Tauri phase of the sun. Input conductivity data for the meteorite parent body were the present carbonaceous chondrite values for temperatures up to 840 C and the electrical conductivity values for olivine above 840 C.

20901 (N—89-14998, pp 1) **Exobiology experiment concepts for Space Station.** Griffiths, L.D.; Devincenzi, D.L. (Management and Technical Services Co., Washington, DC (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The exobiology discipline uses ground based and space flight resources to conduct a multidiscipline research effort dedicated to understanding fundamental questions about the origin, evolution, and distribution of life and life related molecules throughout the universe. Achievement of this understanding requires a methodical research strategy which traces the history of the biogenic elements from their origins in stellar formation processes through the chemical evolution of molecules essential for life to the origin and evolution of primitive and, ultimately, complex living species. Implementation of this strategy requires the collection and integration of data

from solar system exploration spacecraft and ground based and orbiting observatories and laboratories. The Science Lab Module (SLM) of the Space Station orbiting complex may provide an ideal setting in which to perform certain classes of experiments which form the cornerstone of exobiology research. These experiments could demonstrate the pathways and processes by which biomolecules are synthesized under conditions that stimulate the primitive earth, planetary atmospheres, cometary ices, and interstellar dust grains. Exobiology experiments proposed for the Space Station generally fall into four classes: interactions among gases and grains (nucleation, accretion, gas-grain reactions), high energy chemistry for the production of biomolecules, physical and chemical processes occurring on an artificial comet, and tests of the theory of panspermia.

20902 (N—89-14998, pp 2) **Kinetics of mineral condensation in the solar nebula.** Grove, T.L. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

A natural extension of the type of gas-mineral-melt condensation experiments is to study the gas-mineral-melt reaction process by controlling the reaction times of appropriate gas compositions with silicate materials. In a condensing and vaporizing gas-solid system, important processes that could influence the composition of and speciation in the gas phase are the kinetics of vaporization of components from silicate crystals and melts. The high vacuum attainable in the space station would provide an environment for studying these processes at gas pressures much lower than those obtainable in experimental devices operated at terrestrial conditions in which the gas phase and mineral or melt would be allowed to come to exchange equilibrium. Further experiments would be performed at variable gas flow rates to simulate disequilibrium vapor fractionation. In this type of experiment it is desirable to analyze directly the species in the gas phase in equilibrium with the condensed silicate material. This analytical method would provide a direct determination of the species present in the gas phase. Currently, the notion of gas speciation is based on calculations from thermodynamic data. The proposed experiments require similar furnace designs and use similar experimental starting compositions, pressures, and temperatures as those described by Mysen.

20903 (N—89-14998, pp 3) **Kinetics in a turbulent nebular cloud.** MacKinnon, I.D.R.; Rietmeijer, F.J.M. (New Mexico Univ., Albuquerque (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

Model calculations, which include the effects of turbulence during subsequent solar nebula evolution after the collapse of a cool interstellar cloud, can reconcile some of the apparent differences between physical parameters obtained from theory and the cosmochemical record. Two important aspects of turbulence in a protoplanetary cloud include the growth and transport of solid grains. While the physical effects of the process can be calculated and compared with the probable remains of the nebula formulation period, the more subtle effects on primitive grains and their survival in the cosmochemical record cannot be readily evaluated. The environment offered by the Space Station (or Space Shuttle) experimental facility can provide the vacuum and low gravity conditions for sufficiently long time periods required for experimental verification of these cosmochemical models.

20904 (N—89-14998, pp 4) **Crystal-liquid-vapor equilibrium experiments at high temperature (less than or equal to 1800 C) and low, controlled oxygen and hydrogen pressure (10(-1) to 10(-9) PA).** Mysen, B.O. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

Evidence from carbonaceous chrondrites points to refractory oxides in the system CaO-MgO-Al_2O_3-TiO_2-SiO_2-Fe-O as being among the earliest phases to condense from the solar nebula. It is necessary to establish the equilibrium relationships between the relevant crystalline and amorphous phases before the chemical constraints can be meaningfully applied to models of solar system history. Preliminary experiments on earth show that such experiments are feasible. Earth-based experiments suffer from several unavoidable problems. These problems can be overcome by experimentation in the Space Station where the experiments can be conducted under near static pressure conditions and where total pressure equals the sum of controlled hydrogen and oxygen pressures and can be controlled for periods exceeding several hours.

20905 (N—89-14998, pp 2) **Ultraviolet spectroscopy of meteoric debris: in situ calibration experiments from earth orbit.** Nuth, J.A.; Wdowiak, T.J.; Kubinec, W.R. (Charleston Coll., SC (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

It is proposed to carry out slitless spectroscopy at ultraviolet wavelengths from orbit of meteoric debris associated with comets. The Eta Aquarid, Orionid/Halley, and the Persied/1962 862 Swift-Tuttle showers would be principal targets. Low light level, ultraviolet video technique will be used during the night side of the orbit in a wide field, earthward viewing mode. Data will be stored in compact video cassette recorders. The experiment may be configured as a GAS package or in the HITCHHIKER mode. The latter would allow flexible pointing capability beyond that offered by shuttle orientation of the GAS package, and doubling of the data record. The 1100 to 3200 A spectral region should show emissions of atomic, ionic, and molecular species of interest on cometary and solar system studies.

20906 (N—89-14998, pp 2) **Debris-cloud collisions: Accretion studies in the Space Station.** Schultz, P.H.; Gault, D.E. (Murphys Center of Planetology, CA (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The growth of planetesimals in the Solar System reflects the success of collisional aggregation over disruption. It is widely assumed that aggregation must represent relatively low encounter velocities between two particles in order to avoid both disruption and high-ejecta velocities. Such an assumption is supported by impact experiments and theory. Experiments involving particle-particle impacts, however, may be pertinent to only one type of collisional process in the early Solar System. Most models envision a complex protoplanetary nebular setting involving gas and dust. Consequently, collisions between clouds of dust or solids and dust may be a more relistic picture of protoplanetary accretion. Recent experiments performed at the NASA-Ames Vertical Gun Range have produced debris clouds impacting particulate targets with velocities ranging from 100 m/s to 6 km/s. The experiments produced several intriguing results that not only warrant further study but also may encourage experiments with the impact conditions permitted in a microgravity environment. Possible Space Station experiments are briefly discussed.

20907 (N—89-14998, pp 3) **How to make a comet.** Stephens, J.; Saunders, R.S.; Fanale, F. (Hawaii Univ., Honolulu (USA)). Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The primary mandate of NASA is the study of the nature and origin of the solar system. The study of the comets provide information about conditions and processes at the beginning of the solar system. Short period comets and their relatives, the near Earth asteroids may prove to be second only to the sun in importance to the long term survival of civilization for two reasons. The short period comets and the near Earth asteroids are a possible candidate for the cause of mass extinctions of life on Earth; and they may provide the material means for the expansion of civilization into the solar system and beyond. The comets and near Earth asteroids almost certainly represent the most primitive material of the solar system, still tantalizingly unavailable until spacecraft bring

first-hand information. In the meantime comets must be studied by remote means. Laboratory investigations using synthetic cometary materials may add to the knowledge of these interesting objects. Experimentation on comet synthesis is briefly discussed.

20908 (N—89-14998, pp 4) **Volatilization-fractionation of silicates related to chondrite composition.** Walter, L.S. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The compositions of chondritic meteorites are linked to the solar composition. It is believed that the chemistry of the (generally) drop-shaped chondrules which comprise a large portion of these meteorites may present valuable clues to their formation and, ultimately, to the early conditions and processes of the planets. The purpose of this experiment is to determine the nature of volatilization-fractionation of silicate (and related metallic) compositions related to chondrite composition.

20909 (N—89-14998, pp 1) **New techniques for the detection and capture of micrometeoroids.** Wolfe, J.H. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

In order to understand the origin and distribution of the biogenic elements and their compounds in the solar system, it will be necessary to study materials from many classes of objects. Chemical, elemental, and isotopic measurements of returned samples of comets, asteroids, and possibly extra-solar system dust clouds would provide information on a particularly important class: primitive objects. Extraterrestrial micron-sized particles in the vicinity of Earth are one source of such materials that might otherwise be inaccessible. The Space Station appears to be an eminently suitable platform from which to collect and detect these various particles. The primary challenge, however, is to collect intact, uncontaminated particles which will be encountered at tens of kilometers per seconds. A concept for a micrometeoroid detector that could be deployed from the Space Station was developed which uses a large area detector plate implanted with acoustic transducers. When an impact event occurs, the resulting signal is subjected to spectral analysis providing positive detection, momentum information, and angle of incidence. The primary advantage of this detector is the large area which increases the probability of measuring events. A concept of a nondestuctive micrometeoroid collector for use from a Space Station was also developed. The collector utilizes input port charging of the incoming particle followed by staged high voltage deceleration for nondestructive capture. Low velocity particles (local contamination) would be rejected due to insufficient energy and only uncontaminated micrometeoroids would be collected.

20910 (N—89-14998, pp 1) **Experimental constraints on heating and cooling rates of refractory inclusions in the early solar system.** Boynton, W.V. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

The refractory inclusions in carbonaceous chondrites were the subject of considerable interest since their discovery. These inclusions contain minerals that are predicted to be some of the earliest condensates from the solar nebula, and contain a plethora of isotopic anomalies of unknown origin. Of particular interest are those coarse-grained inclusions that contain refractory metal particles (Fe, Ni, Pt, Ru, Os Ir). Experimental studies of these inclusions in terrestrial laboratories are, however, complicated because the dense particles tend to settle out of a molten or partially molten silicate material. Heating experiments in the Space Station technology and microgravity in order to observe the effects of metal nuggets (which may act as heterogeneous nucleation sites) on nucleation rates in silicate systems and to measure simultaneously the relative volatilization rate of siderophile and lithophile species. Neither experiment is possible in the terrestrial environment.

20911 (N—89-14998, pp 2) **Experimental constraints on the origin of chondrules.** Boynton, W.V. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

Chrondule formation was an important (perhaps ubiguitous) process in the early solar system, yet their origins remain elusive. Some points, however, are clear. The precursor material of chondules (dust) was rapidly heated at rates of perhaps thousands of degrees per second and was cooled more slowly. It was proposed to investigate chondrule formation in the Space Station environment via a dust-box (a chamber in which dust can be suspended, heated, and cooled. A microgravity environment is conducive to this kind of experiment because of the significant retardation of settling rates compared with a terrestrial laboratory environment. These long-duration experiments might require the development of technologies to counteract even the small, but finite and permanent gravitation field of the Space Station. Simple, but interesting experiments on dust suspensions immediately present themselves.

20912 **(N—89-15063) Analysis of ISEE-3/ICE solar wind data. Final report.** Coplan, M.A. (Maryland Univ., College Park (USA)). Jan 1989. 6p. (NASA-CR—184652; NAS—1.26:184652). NTIS, PC A02/MF A01.

Under the grant that ended November 11, 1988 work was accomplished in a number of areas, as follows: (1) Analysis of solar wind data; (2) Analysis of Giacobini/Zinner encounter data; (3) Investigation of solar wind and magnetospheric electron velocity distributions; and (4) Experimental investigation of the electronic structure of clusters. Reprints and preprints of publications resulting from this work are included in the appendices.

20913 **(RAL—88-045) Dark matter detection.** Smith, P.F.; Lewin, J.D. (Rutherford Appleton Lab., Chilton (UK)). Aug 1988. 114p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705582/JAW.

This review discusses the principal particle candidates for the galactic dark matter, and summarizes the basic principles of the various ideas which have been proposed for their detection. The detectors fall into several classes, principally (a) electromagnetic detectors for light axions (b) low temperature nuclear recoil detectors for heavy neutral particles such as photinos, and (c) heavy particle nuclear recoil detectors based on ionization. Progress in the development of each of these is summarized, together with prospects and plans for specific experiments in the near future.

20914 **(RIAN—8-87) Self-gravitating plasma.** Bliokh, P.V.; Yaroshenko, V.V. (AN Ukrainskoj SSR, Kharkov. Radioastronomicheskij Inst.). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705591/JAW.

Collective processes in a plasma with charged dust particles with account of gravitational interaction between the particles are considered. Formulae for the dielectric constant are derived in the cases of an isotropic and magnetized plasma. The secular equations are investigated and energy losses of a probe particles are considered. 4 refs.; 2 tabs.

20915 **(RIAN—9-87) Decameter radio emission from Jupiter. 5. A model of the S-burst source.** Ryabov, B.P. (AN Ukrainskoj SSR, Kharkov. Radioastronomicheskij Inst.). 1987. 47p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705592/JAW.

A physical model of the radiation source and an excitation mechanism have been suggested for the S-component in Jupiter's sporadic emission, that provide a unique explanation to most of the interrelated phenomena observed. The model allows a consistent interpretation of the emission cone structure, behavior of the integrated radio spectrum, the probability of S-burst appearance, the location and apparent size of the radiation source, and fine structure details. A mechanism responsible for the S-bursts is discussed in connection with the L-type emission. The relation is traced between parameters of the radio emission and the geometry of Io's magnetic tube. Fluctuations in the tube current amplitude are estimated,

along with the refractive index and mass density of the plasma near the source of radiation. 16 refs.; 5 figs.

20916 **Test of Newton's inverse-square law in the Greenland ice cap.** Ander, M.E.; Zumberge, M.A.; Lautzenhiser, T.; Parker, R.L.; Aiken, C.L.V.; Gorman, M.R.; Nieto, M.M.; Cooper, A.P.R.; Ferguson, J.F.; Fisher, E.; and others. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **62**: No. 9, 985-988(27 Feb 1989).

An Airy-type geophysical experiment was conducted in a 2-km-deep hole in the Greenland ice cap at depths between 213 and 1673 m to test for possible violations of Newton's inverse-square law. An anomalous gravity gradient was observed. We cannot unambiguously attribute it to a breakdown of Newtonian gravity because we have shown that it might be due to unexpected geological features in the rock below the ice.

20917 **Invisible-axion emissions from SN 1987A.** Choi, K.; Kang, K.; Kim, J.E. (Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, Maryland 21218). *Physical Review Letters;* **62**: No. 8, 849-851(20 Feb 1989).

Based on the equivalence theorem of the on-shell S matrix elements independently of nonlinearly realized Goldstone fields, we clarify the discrepancies raised by the use of the pseudovector derivative and pseudoscalar pion-nucleon couplings in the nucleon-nucleon axion bremsstrahlung process which is often taken as the dominant axion emission mechanism from SN 1987 A. In addition, we propose a new method to calculate the axion emission rate from $NN \rightarrow NN\pi$ data, and we compare the result to the theoretical calculation based on the one-pion-exchange approximation.

6402 Atmospheric Physics

20918 **(CTA-IEAV-NT—02/86) Benchmark results in radiative transfer.** Garcia, R.D.M.; Siewert, C.E. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Feb 1986. 55p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705415/JAW.

Several aspects of the F/sub N/ method are reported, and the method is used to solve accurately some benchmark problems in radiative transfer in the field of atmospheric physics. The method was modified to solve cases of pure scattering and an improved process was developed for computing the radiation intensity. An algorithms for computing several quantities used in the F/sub N/ method was done. An improved scheme to evaluate certain integrals relevant to the method is done, and a two-term recursion relation that has proved useful for the numerical evaluation of matrix elements, basic for the method, is given. The methods used to solve the encountered linear algebric equations are discussed, and the numerical results are evaluated. (M.C.K.).

20919 **(INPE—3546) Study of X-rays at the atmosphere of the South Atlantic Magnetic Anomaly.** Pinto Junior, O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)). Jun 1985. 257p. NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS. Order Number DE88705532/JAW.

A study of X-rays at the atmosphere of the South Atlantic Magnetic Anomaly is presented in this work, in which an analysis of all existing balloon measurements carried out at this region has been done. It is concluded that the X-ray flux due to electron precipitation depends strongly on geomagnetic activity, reaching at Sao Jose dos Campos a maximum doward flux of 10/sup -2/ photons/cm/sup 2/.sec.KeV for 4g/cm/sup 2/ and for the energy range of 30-150KeV. The related flux of precipitating electrons was computed by Monte Carlo method with values of about 500 electrons/cm/sup 2/.sec and energy espectra of the type e/sup -T/200/. This electron flux is shown to represent the main ionization flux for the atmosphere at about 60 Km height. Furthermore, the atmospheric and diffuse components were determined at balloon altitudes (approximately 5g/cm/sup 2/) of Sao Jose dos campos (λ/sub m/ = 11/sup 0/S) to be of the same order.

20920 (N—89-14998, pp 1) **Magnetospheric simulation at the Space Station.** Lopez, R.E.; Freeman, J.W.; Michel, F.C. Nov 1987. NTIS, PC A09/MF A01. (NASA-CP—2494; S—566; NAS—1.55:2494; CONF-8609469—).

From Experiments in planetary and related sciences and the space station; Tempe, AZ, USA (15 Sep 1986).

It is proposed that a strong magnet (terrella) be flown at or near the Space Station to create an artificial magnetosphere in a laboratory setting. The relative flow of the ionosphere past the terrella will constitute a plasma wind that will interact with the magnetic field of the terrella to produce a localized magnetosphere. This object could then be extensively studied using diagnostic probes attached to the Space Station or with free flyers. The space and storage requirements would be minimal, since the experiment would be conducted outside the Space Station. The total equipment would consist of several terrella (with varying surface conductivities), approximately 3 small magnetometer/plasma diagnostic packages, and several gas canisters for upstream seeding. Power requirements would be approximately 60 watts. Several track mounted tethers, each approximately or 200 m long in length, with track parallel to the orbital motion and 100 m long, are also needed. Astronaut time needed would be minimal in the tethered configuration (approximately 4 man hours/week). A free flying configuration, while not needing the tether track, would require much more human interaction.

20921 **(RIAN—10-87) Geophysical control of amplitude and phase parameters of VLF propagation along mid-latitude paths.** Bezrodnyj, V.G.; Shubova, R.S. (AN Ukrainskoj SSR, Kharkov. Radioastronomicheskij Inst.). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705593/JAW.

The effective height of the VLF waveguide has been analysed as a function of geomagnetic activity variations for different models deduced from VLF phase measurements. It is confirmed once again that the effective height is controlled at night by the current Ap-values. As Ap increases, the mean height decreases but shows stronger variations. The radio signal amplitude is not as strongly dependent on the geomagnetic activity, being controlled by the intensity of galactic cosmic rays. A relation has been established between anomalous night-time variations in the VLF amplitude and cosmic ray variations during Forbusch-effect. 17 refs.; 5 figs.

20922 **Multiple pulse relativistic electron beam energy loss by photometric observation of fluorescence from atmospheric propagation.** Karl R.R. Jr. (Los Alamos National Laboratory, Earth & Space Sciences Division, Atmospheric Sciences Group, Los Alamos, New Mexico 87545). *Applied Optics;* **28**: No. 3, 446-450(1 Feb 1989).

Optical observations of the air fluorescence show that the rate of energy deposition of a repetitively pulsed high-current-density relativistic electron beam increases with pulse number. The data suggest that the high electric fields of the second and later pulses accelerate the unrecombined electrons from previous pulses and create additional ionization and energy deposition by electron avalanche. As expected, this optical fluorescence enhancement is seen to increase as the air pressure is decreased, because the increased electron lifetime at lower pressures leaves a higher electron density when subsequent pulses arrive. Absolute calibration of electron beam current and optical intensities has permitted determination of the fluorescence efficiencies for each pulse as a function of atmospheric pressure. The fluorescence efficiencies for the first electron pulse reproduce previous observations of optical efficiency for ionizing radiation in air.

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REFER ALSO TO CITATION(S) 19306, 20080, 20093, 20163, 20178, 20181, 20182, 20195, 20197, 20451, 21337

20923 (ANL/PPRNT—89-107) Removal of nonorthogonality in the Born theory used for study of electron capture in high energy ion-atom collisions. Kimura, M. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008439/JAW.

We show the complete removal of the nonorthogonality of wave functions between initial and final states in the Born theory. Hence, this treatment offers more realistic electron capture cross sections in high energy ion-atom collisions. Representative results for resonant electron capture in $H^+ + H$ collision are discussed in conjunction with other perturbative results. 10 refs., 1 fig.

20924 (ANL/PPRNT—89-110) Green's-function solutions to dynamical-simulated annealing and steepest-descents equations of motion. Benedek, R.; Min, B.I.; Garner, J. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008437/JAW.

Solutions to the dynamical-simulated-annealing and the steepest-descents equations of motion for electron states are presented. The relations proposed by Payne et al. and by Williams and Soler can be obtained from the first-born approximation by applying additional decoupling approximations. A numerical example is presented to contrast the behavior of the Green's function and finite-difference solutions to the steepest-descents dynamics. 14 refs., 2 figs.

20925 (ANL/PPRNT—89-138) Differential cross sections for electron capture in highly charged ion collisions with He and H_2 in the KeV regime. Kimura, M.; Lane, N.F. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008344/JAW.

Differential cross sections (DCS) for single electron-capture processes in O^{8+} on He and N^{7+} on H_2 collisions are studied using a semiclassical traveling molecular orbital expansion method. Theoretical results are in good accord with recent measurements. The influence of a double electron-capture process on the DCS is also discussed. 10 refs., 2 figs.

20926 (ANL/PPRNT—89-140) Observation of a localized 5f photoemission satellite in narrow-band uranium compounds. Arko, A.J.; Yates, B.W.; Koelling, D.D.; Dunlap, B.D.; Zolnierek, Z.; Mitchell, A.W.; Lam, D.J.; Olson, C.G.; del Giudice, M. (Argonne National Lab., IL (USA)). Oct 1986. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008342/JAW.

We show by means of systematic photoemission measurements on several sets of uranium-based ternary alloys that the "two-peaked" f-electron spectrum found in Ce-compounds is also found in uranium heavy fermions, as well as all narrow band 5f materials. The 5f spectra consist of a superposition of features entirely consistent with those expected from band structure calculations, plus a broad peak identified as a poorly screened 5f satellite not derived from the ground state. 20 refs., 2 figs.

20927 (ANL/PPRNT—89-164) Natural bond orbital analysis of charge transfer in Al_4{hor←ellipsis}CO and Al_4{hor←llipsis}NH_3. Reed, A.E.; Curtiss, L.A.; Weinhold, F. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008359/JAW.

In this paper, we use the natural bond orbital (NBO) method to analyze the bonding in Al_4{hor←ellipsis}CO and Al_4{hor←ellipsis}NH_3. The NBO method has been used to study the bonding in intermolecular complexes as well as in a number of molecular species. It leads to an alterative definition of charge transfer (CT) energy, based on a different treatment of intermolecular overlap between filled and unfilled orbitals than in the frequently used Morokuma scheme.

20928 (ANL/PPRNT—89-170) Sub-excitation electron interactions in rare gases: I, Evidence for the time evolution of the sub-excitation spectrum. Cooper, R.; Sauer, M.C., Jr. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008353/JAW.

The production of the '2p' electronic excited states of the rare gases neon, argon, krypton and xenon has been studied using picosecond pulse radiolysis techniques. At pressures below about 5 torr, the emission from these excited states shows a pressure dependent growth-decay pattern. Kinetic analysis of the growth-decay curves reveal formation rate constants which are all greater than 10^{12}M/sup {minus}1/sec/sup {minus}1/. These observations preclude atom-atom collisional processes and support an excitation mechanism involving collisional energy loss from electrons. It is thus concluded that the secondary electron spectrum in pure rare gases at pressures below a few torr takes a few nanoseconds to degrade to energies below that of the lowest excited state. This time scale therefore (by definition) corresponds to the time needed to form subexcitation electrons. In 1 atmosphere of rare gas the time taken would be of the order of 20--30 picoseconds. 5 refs., 4 figs., 1 tab.

20929 (ANL/PPRNT—89-171) A stable, rapidly converging conjugate gradient method for energy minimization. Watowich, S.J.; Meyer, E.S.; Hagstrom, R.; Josephs, R. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008352/JAW.

We apply Shanno's conjugate gradient algorithm to the problem of minimizing the potential energy function associated with molecular mechanical calculations. Shanno's algorithm is stable with respect to roundoff errors and inexact line searches and converges rapidly to a minimum. Equally important, this algorithm can improve the rate of convergence to a minimum by a factor of 5 relative to Fletcher-Reeves or Polak-Ribiere minimizers when used within the molecular mechanics package AMBER. Comparable improvements are found for a limited number of simulations when the Polak-Ribiere direction vector is incorporated into the Shanno algorithm. 24 refs., 4 figs., 3 tabs.

20930 (BONN-IR—87-39) Extensions and applications of the g-Hartree theory for atoms. Millack, T. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Nov 1987. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757119/JAW.

By consequent use of functional techniques the Schroedinger picture of the quantum field theory has been described in closed analogy to qunatum mechanics. The starting point of a perturbative expansion forms the generalized infinite-dimensional harmonic oscillator for which a Fock-space representation for the wave functionals has been developed. The perturbation series of the wave functionals based on this has the shape of a Rayleigh-Schroedinger expansion. If in the construction of the Fock space the g-Hartree potential is used and g is optimized to the whole energy of the system so that the unperturbed energy is equal to the perturbed energy so a Brillouin-Wigner expansion arises. By this it was shown that the scattering theory can be also constructed in analogy to quantum mechanics. The asymptotic states are formed by the fully correlated wave functionals of the atom and the free electron and the channel T matrix fulfills a Lippmann-Schwinger equation in the normal form. Some approaches for the practical solution of this equation were discussed. The Rayleigh-Schroedinger form of the expansion was then used to formulate a g-Hartree expansion for hyperfine constants for atoms. The dipole constants for atoms with one electron in the open shell from lithium to thallium were for the ground state and the excited p states calculated in first order. (orig./HSI).

20931 **(CEA-N—2584) Technics of polarization and polarimetry.** Boudard, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1988. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756995/JAW.

In these lectures we describe the various tools used in polarization experiments. We emphasize the various ways to obtain polarized particles (beams and targets). We give ideas about the fundamental mechanisms involved and typical performances.

20932 **(CONF-8807155—1) Rotating clusters: Centrifugal distortion, isomerization, fragmentation.** Li, D.H.; Jellinek, J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007267/JAW.

From 4. international symposium on small particles and inorganic clusters; Aix-en-Province, France (5 Jul 1988).

The effect of the overall rotation, as characterized by the total angular momentum, on the structure of an Ar_{13} cluster is studied by using a new technique for separation of the rotational motion from vibrations. No a priori limitation on the degree of nonrigidity of the cluster is imposed. The different structures for different total angular momenta of the cluster are arrived at by a thermal quenching procedure which preserves the overall rotation. It is shown that the centrifugal distortion is anisotropic and it may lead to isomerization transitions and even fragmentation of the cluster. 5 refs., 4 figs.

20933 **(DOE/ER/13421—8) Near resonant absorption by atoms in intense, fluctuating fields: [Progress report].** (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). [1989]. Contract FG02-85ER13421. 3p. NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89008573/JAW.

During the present grant period preparations for photon echo studies of the role of phase fluctuations of an optical driving field resonant with the $^1S_0$ - $^3P_1$ transition in ^{174}Yb are moving forward. This experimental study emphasizes the role of fluctuations as a decorrelating mechanism on a phased array of excited atoms. Improvements in laser stabilization and in the quality of the fluctuation spectrum have been carried out and the first spectroscopic measurements will be carried out during this grant year. In response to an important recent theoretical study we have also applied the phase fluctuation synthesizing capability to the study of the atomic sodium resonance fluorescence line profile, driven by a phase fluctuating laser. The measured fluctuations in the fluorescence, characterized in terms of the standard deviation of the fluorescence intensity, have an unexpected and strong dependence on detuning of the driving laser.

20934 **(DOE/ER/13630—T1) Many-body processes in atomic and molecular physics: Technical progress report, September 1, 1988--August 31, 1989.** Chu, Shih-I. (Kansas Univ., Lawrence (USA). Dept. of Chemistry). Feb 1989. Contract FG02-86ER13630. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008228/JAW.

This report discusses the following topics: Generalized Floquet Theoretical Treatments of Intense Field Multiphoton Processes; Dynamics of Multiphoton Excitation and Quantum Diffusion in Rydberg Atoms; Quantum Scattering via the S-Matrix Version of the Kohn Variational Principle; Multiphoton Excitation and Population Inversion by Coherent Pulses; and Pressure Broadening and Laser-Induced Spectral Line Shapes. 17 refs., 7 figs.

20935 **(FRCEA-TH—118) Theoretical study of non reactive collisions between alkaline atoms and hydrogen or deuterium molecules. Calculations and analysis of the potential surfaces. Application to the fine structure transitions of the Rubidium.** Rossi, F.N. (Paris-11 Univ., 91 - Orsay (France)). Oct 1986. 208p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88757205/JAW.

The adiabatic potential lines are first obtained through the use of a pseudo-potential, depending on the electronic orbital moment. A perturbative method is then used to generate the potential surfaces, according to the potential lines. A quantum calculation in the thermal energy domain is realized, for the cross-sections concerning the structure transitions of the Rubidium, induced by the collision with hydrogen or deuterium molecules. This allowed the interpretation of the experimentally observed isotopic effect.

20936 **(GSI—88-04) Inner-shell ionization in ion-atom collisions.** Mehler, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Fachbereich 13 Physik). Feb 1988. 540p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88757124/JAW.

The excitation mechanisms are discussed in this thesis in semiclassical approximation. A method is applied which solves the time-dependent Dirac equation in principle completely and contains all interactions. Thereby the Dirac equation is represented as an infinite system of coupled first-order differential equations - the coupled channel equations. The 'channels' are thereby the eigenstates of the considered Hamiltonians, in the case of the excitation of the atomic states of the target just the eigenfunctions of the Hamiltonian of the target system and in the case of the molecular excitation the eigenstates of the two-center Dirac Hamiltonian. (orig./HSI).

20937 **(GSI—89-01-Prepr.) Influence of vacuum polarization corrections of order $\alpha(Z\alpha)$ and $\alpha(Z\alpha)$/sup 3/ in hydrogen-like uranium.** Soff, G.; Mohr, P.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); National Bureau of Standards, Gaithersburg, MD (USA)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); National Bureau of Standards, Washington, DC (USA)). Jan 1989. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756940/JAW.

Energy shifts of a bound electron in hydrogen-like uranium due to vacuum polarization corrections of order $\alpha(Z\alpha)$ and $\alpha(Z\alpha)$/sup 3/ are calculated. It is shown that for Rydberg levels, the higher-order Wichmann-Kroll correction of order $\alpha(Z\alpha)$/sup 3/ is greater than the order $\alpha(Z\alpha)$ Uehling contribution.

20938 **(GSI—89-08-Prepr.) Higher-order vacuum polarization corrections in muonic atoms.** Schmidt, J.M.; Soff, G.; Mohr, P.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); National Bureau of Standards, Gaithersburg, MD (USA)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); National Bureau of Standards, Washington, DC (USA)). Jan 1989. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756945/JAW.

Energy shifts in muonic atoms caused by vacuum polarization of order $\alpha(Z\alpha)$/sup n/ with $N \geqq 3$ are calculated. Nuclear size corrections are taken into account. The calculations are performed for all muonic levels from the 1s/sub 1/2/-state to the 5g/sub 9/2/-state in various atoms with nuclear charge Z between 30 and 100.

20939 **(GSI—89-10-Prepr.) Coupled-channel results for atomic excitations in intermediate-energy heavy-ion collisions.** Reus, T. de; Mueller-Nehler, U.; Soff, G.; Reinhardt, J.; Graf, S.; Mueller, B.; Greiner, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Jan 1989. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756947/JAW.

Electron and positron emission spectra produced in heavy-ion collisions with beam energies in the range E/sub Lab/=8-100 MeV/u are calculated up to kinetic lepton energies of 50 MeV. Earlier predictions concerning the observability of nuclear stopping times in the range tau=1-10 fm/c by means of the slope of δ-electron spectra are confirmed. However, the effect of time-delay is somewhat less pronounced than predicted in first-order perturbation theory.

20940 **(IC—88/316) Rotating two electron atom in an external electric field.** Mahecha, J.G. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705982/JAW.

Three exact rigid-body solutions for a rotating two-electron atom under the influence of an electric field along the rotation axis have been obtained with a classical approach. The stability analysis of the linearized motions around each of the equilibrium motions was made for different values of the electric field. We find an exact solution, which in the zero case, gives a known solution as a rotor, another exact solution which in the zero field case gives the Wannier unbound solution, and a numerical solution which in the zero field case gives the asymmetric top or Langmuir solution. We find critical values of the electric field beyond which the equilibrium is not possible. Values for the classical polarizability of rotating H/ sup -/ and He are reported. (author). 14 refs, 4 figs.

20941 **(ICEFIZ-FT—305-1987) Bistability in a laser with injected signal.** Dorobantu, I.A.; Vlad, V.I.; Ursu, I. (Central Inst. of Physics, Bucharest (Romania)). Apr 1987. 34p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706003/JAW.

A unified description of bistability is given in free running lasers, optical bistable devices, ring lasers and lasers with an injected signal (LIS). A general review of laser instabilities is also presented in the frame of the theory of elementary catastrophes, emphasizing the apparence of higher order catastrophes in the case of a LIS suggesting thus a possibility to devise from first principles the whole hierarchy of laser instabilities. Experimental results on the bistability in the polarisation of LIS are also discussed. (authors).

20942 **(ICEFIZ-FT—327-1988) Linear response of the hydrogen atom in Stark states to a harmonic uniform electric field.** Marian, T. (Bucharest Univ. (Romania)). (Central Inst. of Physics, Bucharest (Romania)). Feb 1988. 19p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706005/JAW.

The influence of a weak harmonic uniform electric field, turned on adiabatically, on a non-reltivistic hydrogen-like atom is examined.

20943 **(ICEFIZ-FT—328-1988) Bound-bound to-photon transition matrix elements for the hydrogen atom in the dipolar approximation.** Marian, T. (Bucharest Univ. (Romania)). (Central Inst. of Physics, Bucharest (Romania)). Feb 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706006/JAW.

The Kramers-Heisenberg matrix elements for bound-bound transitions of a non-relativistic hydrogen-like atom have been evaluated.

20944 **(IFTAR-LOP—59-1987) Atomic frequency-time-length standards.** Gheorghiu, O.C.; Mandache, C. (Central Inst. of Physics, Bucharest (Romania). Inst. for Physics and Technology for Radiation Devices). Jan 1987. 56p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88706049/JAW.

The principles of operative of atomic frequency-time-length standards and their principle characteristics are described. The role of quartz crystal oscillators which are sloved to active or passive standards is presented. (authors).

20945 **(INIS-mf—11363) High-resolution tandem mass spectrometer for the collision-induced dissociation of large molecule ions.** Ouwerkerk, C.E.D. (Amsterdam Univ. (Netherlands)). 1 Jul 1988. 154p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706061/JAW.

Includes Dutch summary.

Instrumental development in the field of tandem mass spectrometry is described in order to use the technique for the analysis of large organic molecules. Experiments are also described in which the process of collision-induced dissociation (CID) is investigated. The fragmentation pattern of CH/sub 4//sup +/ has been measured for three different target gases He, Ar and Xe. From these measurements fragmentation cross sections are calculated. 192 refs.; 47 figs.; 6 tabs.

20946 **(INIS-mf—11364) Collision-induced intramultiplet mixing for the Ne**[(2p)/sup 5/(3p)] + He or Ne system.** Manders, M.P.I. (Technische Univ. Eindhoven (Netherlands)). 17 May 1988. 259p. NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS. Order Number DE88706062/JAW.

Includes Dutch summary.

For the Ne**-He case, experimental data are confronted with quantum mechanical calculations. Quantum mechanical coupled-channel calculations using model potentials as input are presented, followed by a semiclassical approach which provides more physical insight. Experimental results are presented for the Ne**-Ne system with a discussion of the general principles involved in symmetrization. 184 refs.; 93 figs.; 19 tabs.

20947 **(INIS-mf—11377) Associative ionization of two laser excited Na atoms. An experimental study of polarization and velocity dependence at thermal energies.** Meijer, H.A.J. (Rijksuniversiteit Utrecht (Netherlands)). 9 May 1988. 163p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706075/JAW.

Includes Dutch summary.

An investigation into the associative ionization of two sodium atoms excited by polarized laser beams is described. It was possible to excite the Na atoms in a velocity-selective way by exploiting the Doppler effect. The excitation of Na to the 3/sup 2/P/ sub 3/2/, F=3 level is discussed on the basis of so-called saturation curves. Experiments with seven different combinations of polarization of the two exciting laser beams are described and the results discussed. 86 refs.; 53 figs.; 6 tabs.

20948 **(INIS-mf—11379) Wondrous world of transport and acceleration of intense ion beams.** Siebenlist, F. (Amsterdam Univ. (Netherlands)). 3 Jun 1987. 124p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706077/JAW.

Includes Dutch summary.

A theoretical and experimental study of the transport, bunching and acceleration of intense ion beams in periodic focusing channels is described. The aim is to show the feasibility of accelerating high current ion beams with a Multiple Electrostatic Quadrupole Array Linear ACcelerator (MEQALAC). 83 refs.; 51 figs.; 3 tabs.

20949 **(INIS-mf—11916) X-ray absorption experiments on rare earth and uranium compounds under high pressure.** Schmiester, G. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). 9 Dec 1987. 161p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88757142/JAW.

After an introduction into the phenomenon of the mixed valency and the method of measuring the microstructures by X-ray absorption spectroscopy in the area of the L edges under pressure, the results of investigations at selected substitutes of the chalcogenides and puictides of the rare earths and the uranium were given. Thus, pressure-induced valency transitions in YbS and YbTe, instabilities in valency and structural phase transitions in EUS and SmTe as well as the change in the electron structure in USb under pressure were investigated in order to answer questions of solid state physics (e.g. semiconductor-metal transitions, correlation between valency and structural phase transitions). Hybridization effects in L/sub III/ spectra of formally tetravalent Ca are analyzed at CeF/sub 4/ and CeO/sub 2/ (insulators) and the role of final state effects in the L/sub III/ spectra are analyzed at EuP/sub 2/ P/sub 2/ and TmSe-TmTe (semiconductor systems).

20950 **(IS-T—1403) Diagnostic and normalization techniques for laser-generated plumes based on beam deflection and photoacoustic wave measurements.** Chen, Gouying. (Ames Lab., IA (USA)). Feb 1989. Contract W-7405-ENG-82. 124p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007675/JAW.

Because of its excellent spatial resolution and sensitivity, the laser microprobe analyzer (LMA) has become an indispensable tool for direct solid analysis. The laser microprobe has been hyphenated to a variety of analytical techniques, in particular, optical spectroscopy and mass spectrometry. However, despite its widespread use, it suffers from relatively poor precision and accuracy. To better understand the laser-solid interactions, especially for those neutral and nonemitting plume species, a new universal detector is developed. The density gradient associated with the transient atomization event is intercepted by a probe laser beam, resulting in beam deflection (BD) in far field. Both the shape and magnitude of the BD signal agree well with the predictions based on a plume model with a radially linear density profile. The probe laser beam can be well focused on the plume, generating a BD signal in a single pass, so both spatial and temporal resolutions are excellent. The plume dynamics (expansions and drift), the spatial density profile, and the amount of evaporated material can be derived with a limit of detection of 1 ng. This technique compares favorably with interferometry for diagnostics of transient atomization events and will find widespread applications. The correlation between atomic emission and photoacoustic wave associated with laser-generated plumes is investigated. Over a widely varied vaporization conditions including laser power, focusing, surface treatment and, to a limited extent, chemical compositions, the amplitude of the photoacoustic wave is linearly related to the atomic emission intensities of both major and minor components. 253 refs., 17 figs.

20951 **(JINR-E—4-88-404) Solving problems on hydrogen atom in electric field by means of REDUCE.** Abrashkevich, A.G.; Vinitsky, S.I.; Rostovtsev, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 22 Jun 1988. 12p. (CONF-8807154—1). NTIS (US Sales Only), PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006589/JAW.

From International symposium on symbolic and algebraic computation; Rome, Italy (4 Jul 1988).

A technique of solving perturbation theory problems of quantum mechanics in the language of the dynamic symmetry group by means of REDUCE computer algebra system is discussed. The program for analytical calculation of energy and wave functions of hydrogen atom in an electric field in arbitrary order of the perturbation theory is presented. 9 refs.

20952 **(LBL—25545) Report on the workshop on new directions in soft x-ray near-threshold phenomena.** Lindle, D.W.; Perera, R.C.C. (eds.). (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 56p. (CONF-870353—Summ.). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008857/JAW.

From Annual SDI technical achievements symposium; Pacific Grove, CA, USA (1 Mar 1987).

The "Workshop on New Directions in Soft X-Ray Near-Threshold Phenomena" was held at the Asilomar Conference Center in Pacific Grove, CA on March 1--4, 1987. It was attended by 59 scientists from 8 countries, representing 27 institutions. Major funding for the meeting was donated by L-Division of the Lawrence Livermore National Laboratory, who hosted and organized two previous workshops on photoabsorption and scattering in the soft x-ray energy range. Additional funding was provided by the User's Group of the Advanced Light Source. The Workshop, as its name suggests, emphasized physical phenomena in atoms, molecules, and solids near inner-shell thresholds. Of particular interest were threshold ionization, post-collisional interaction, resonant photoemission and fluorescence, and multi-electron effects such as shake-up and shake-off. In these areas and others, special consideration was given to presenting recent discoveries and potential "new directions" for future work.

20953 **(RAL—88-101) Laser-plasma XUV sources.** O'Neill, F. (Rutherford Appleton Lab., Chilton (UK)). Nov 1988. 32p. (CONF-8808203—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88706128/JAW.

From 35. Scottish University summer school in physics: laser plasma interactions '88; St. Andrews, UK (7 Aug 1988).

The paper presents a set of lecture notes prepared for the 35th Scottish University Summer School in physics, which took place at St. Andrews, August 1988. The subject of the Summer School's studies was "Laser Plasma Interactions". The lecture notes are divided into three main topics:- characteristics of laser-plasma XUV sources, comparison of laser-plasma and synchrotron XUV sources, and applications of laser-plasma XUV sources. (U.K.).

20954 **(SFB—162-88-05-170) Partial and state selective cross sections for multiple ionization of rare gas atoms by electron impact.** Lebius, H.; Binder, J.; Koslowski, H.R.; Wiesemann, K.; Huber, B.A. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich; Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). Jul 1988. 26p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich.

Partial ionization cross sections for single electron impact on rare gas atoms (Ne, Kr and Xe) have been measured for charge states up to $q = 8$. In addition, by using the translational energy spectroscopy technique (TES) we have determined state selective cross sections for the production of doubly and triply charged neon ions in specific electronic states. The contributions of direct and inner shell processes are discussed.

20955 **(SFB—162-88-05-175) State-selective single electron capture by multiply charged ions: Reaction window and multichannel Landau Zener calculations.** Lebius, H.; Koslowski, H.R.; Huber, B.A. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich; Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). Jul 1988. 20p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 162 - Plasmaphysik Bochum/Juelich.

Single electron capture by triply charged rare gas ions colliding with various rare gas atoms has been studied by means of translational energy spectroscopy (TES) at low collision energies. The final state population is discussed in terms of the so-called reaction window predicted by various models as well as by extended multi-channel Landau Zener calculations (MCLZ). The analysis shows the limitations of such model descriptions and yields information on the coupling strength in the case of inner shell capture or multi-electron processes.

20956 **(UCRL—99003) Measurement of ground state copper density using hook spectroscopy.** Molander, W.A. (Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 10p. (CONF-890145—17). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005098/JAW.

From SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89; Los Angeles, CA, USA (15 Jan 1989).

The density of ground state copper atoms has been measured in an operating large-bore copper laser using hook spectroscopy. In this method, dispersion, due to the copper resonance lines at 327.4 nm and 324.7 nm, is measured by placing the copper laser tube in one arm of a Mach-Zehnder interferometer illuminated by a broad bandwidth UV source. The light source was a Nd:YAG-laser-pumped dye laser which was modified to have a 15 nm bandwidth and then frequency doubled in a 3 mm thick KDP crystal, resulting in a UV beam with an 8 nm bandwidth. The Nd:YAG laser was synchronized with the copper laser, allowing a time resolution of 8 ns. Copper density was measured both as a function of time and as a function of radial position across the bore of the tube. The radial resolution was about 2mm. The space-dependent data gives information about the gas temperature distribution since the density is inversely proportional to the temperature. The gas temperature distribution found in this way agrees well with the predictions of a simple heat-conduction model which assumes uniform power deposition. The power deposition found in this way was compared to that found by calorimetry. 7 figs., 10 refs.,

20957 **(UCRL—100259) Molecular dynamics and irreversibility, from Boltzman to Nose.** Hoover, W.G. (Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 73p. (CONF-890180—1). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006740/JAW.

From The Boltzmann seminar; Hohe Wand, Austria (1 Jan 1989).

Throughout Boltzmann's life-long atomistic study of irreversibility, he emphasized the one-body distribution function f_1, averaged over many particles, with the underlying dynamics taken to be a series of two-body collisions. His derivation of the H theorem, linking dynamics and thermodynamics, remains the major accomplishment in understanding the Second Law of Thermodynamics. Today his analytic one-body approach has largely been superceded by using fast computers to simulate many-body "Molecular Dynamics". Fermi originated Molecular Dynamics at Los Alamos in 1953. His few-body one-dimensional chains launched a generation of numerical studies of Lyapunov-unstable ordinary different equations. By 1972 computers could simulate 1000-body gases, liquids, or solids, and a new nonequilibrium mechanics was developing to facilitate this work. In 1984, Nose made a major contribution. He showed how to introduce macroscopic variables, such as temperature, pressure, and heat flux, directly into time-reversible microscopic equations of motion. When Nose's mechanics is applied to nonequilibrium systems zero-volume "strange attractors" form in the many-body phase space. The attractors provide a new explanation for the classical problem of irreversibility that fascinated Boltzmann. Here I trace the evolution of molecular dynamics from Fermi's work at Los Alamos to Nose recent work, and I speculate on the applicability of the new nonequilibrium ideas to quantum systems. 62 refs., 24 figs.

20958 **Optimization of H^- production from a small multicusp ion source.** Leung, K.N.; Hauck, C.A.; Kunkel, W.B.; Walther, S.R. (Accelerator and Fusion Research Division, Lawrence Berkeley Laboratory, 1 Cyclotron Road, Berkeley, California 94720). *Review of Scientific Instruments;* **60**: No. 4, 531-538(Apr 1989).

A small multicusp source has been developed to generate volume-produced H^- ion beams in pulsed operation. To obtain high H^- current densities ($J^- > 250$ mA/cm^2), this source requires relatively high gas pressure and high discharge power. Experiments have been conducted to improve the arc and gas efficiencies, the beam pulse shape, and the H^- to electron ratio in the extracted beam by optimizing the filter magnetic field, the thickness and axial position of the extraction aperture in the plasma electrode, and by mixing xenon or other elements with hydrogen in the discharge. The biggest improvement is achieved by adding cesium to the source, resulting in a fivefold increase in the extractable H^- current and a substantial drop in the e/H^- ratio. In order to improve the lifetime of the cathode, both filament and coaxial type LaB_6 cathodes have been developed and have been operated successfully in this H^- source.

20959 **Complex periodic orbits in the rotational spectrum of molecules: The example of SF_6.** Robbins, J.M.; Creagh, S.C.; Littlejohn, R.G. (Department of Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 6, 2838-2854(15 Mar 1989).

Periodic orbit theory expresses, in a semiclassically approximate way, the trace of the energy-dependent Green's function of a quantum-mechanical system in terms of a sum over periodic orbits of the corresponding classical system. In this paper a periodic orbit sum is carried out for a Hamiltonian describing the rotational dynamics of the SF_6 molecule. Following Miller [J. Phys. Chem. 83, 960 (1979)], classically forbidden, or "tunneling" orbits are included in the sum. A closed-form expression for the trace of the energy-dependent Green's function is obtained; it depends on the actions and Maslov indices of the classical orbits, as well as the irreducible representatives of the generators of the molecular point group. The expression reproduces the rich structure characteristic of the rotational spectra of symmetric molecules, including the exponentially near degeneracies for large angular momentum, and the periodicities in eigenvalue symmetry assignments. The methods used here complement the extensive studies of Harter and Patterson.

20960 **Ultrahigh-resolution (1+1) photoionization spectroscopy of Kr I: Hyperfine structures, isotope shifts, and lifetimes for the n = 5,6,7 $4p^5ns$ Rydberg levels.** Trickl, T.; Vrakking, M.J.J.; Cromwell, E.; Lee, Y.T.; Kung, A.H. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory Department of Chemistry, University of California at Berkeley, Berkeley, California 94720). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 6, 2948-2955(15 Mar 1989).

High-resolution measurements of the hyperfine structures and isotope shifts are reported for Kr I n = 5,6,7 $4p^5ns$ Rydberg levels, obtained using an extreme-ultraviolet laser with a bandwidth of 210 MHz in a resonant two-photon-ionization scheme. Use of known I_2 frequencies yields an improved absolute calibration of the Kr energy levels by more than one order of magnitude. The nuclear quadrupole hyperfine structure indicates that the $4p^56s$ and $4p^57s$ states are described by a pure jj-coupling scheme, whereas the $4p^55s$ states depart from a pure jj-coupling scheme by 0.37(6)%. The magnetic hyperfine structure shows that the $4p^5ns$ states are mixed with $4p^5n'd$ states. The isotope shifts can be described as pure mass effects within the precision of our experiment. For the $4p^56s$ and $4p^57s$ states, lifetimes were determined that differ markedly from theoretical literature values.

20961 **Coherent intermittency in the resonant fluorescence of a multilevel atom.** Porrati, M.; Putterman, S. (Physics Department, University of California, Los Angeles, California 90024). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 6, 3010-3030(15 Mar 1989).

Time correlations in the fluorescence of a multilevel atom are studied in terms of the quantum statistics which describe the emission of the next photon. The next photon equations are substantially simpler than the a photon equations (or so-called optical Bloch equations) yet they contain phase information lost in the averaging procedure that yields the a photon equations. Employing the next photon equations we present a quantum formalism in which the time development of the wave function of the atom is dramatically modified by the observation of a dark period. This "collapse" of the quantum state due to measurements with a null result (such as the failure to record events in a photodetector) is the cause of intermittent atomic fluorescence even when the exciting field is arbitrarily coherent. The next photon and a photon formalisms are contrasted and applied to photon antibunching. The phenomenon of photon bunching which characterizes sideband correlations is also calculated. Observable effects particular to the coherent intermittency are emphasized.

20962 **Threshold behavior of the M-shell photoionization of argon.** Saha, H.P. (Department of Physics, University of Central Florida, Orlando, Florida 32816-0993). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2456-2460(1 Mar 1989).

The multiconfiguration Hartree-Fock method, which has been extended to study photoionization of atoms, is applied to calculate the 3s→kp photoionization cross section of argon. It has been shown that the interchannel interaction associated with the 3p→kd transition, which is very strong in the 3s subshell photoionization cross section, can be very efficiently simulated by the bound-continuum channel interaction associated with the 3p→3d transition. The length and velocity forms of cross section agree very well throughout the range of energies considered. Our results compare well with other theoretical estimates and are in better agreement with experimental measurements.

20963 **Electron-impact double-ionization cross sections for Xe/sup 8+/.** Mueller, D.W.; Wang, L.J.; Gregory, D.C. (Department of Physics, University of North Texas, Denton, Texas 76203). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2381-2384(1 Mar 1989).

Absolute cross-section measurements are presented for the double ionization of Xe/sup 8+/ by electron impact from below threshold to 1500 eV. A search for direct double ionization indicates that this process is small or negligible compared to the single-electron processes which contribute to double ionization. The presence of a high percentage of metastable target ions in the interac-

tion region of this experiment significantly affects the interpretation of the measured cross sections and indicates the potential importance of selected metastable ions in plasmas.

20964 **Coupling effects for electron-impact excitation in the potassium isoelectronic sequence.** Pindzola, M.S.; Griffin, D.C.; Bottcher, C. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6372). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2385-2391(1 Mar 1989).

Electron-impact excitation cross sections for outer-subshell transitions in Ca^+, Sc/sup 2+/, Ti/sup 3+/, Cr/sup 5+/, and Fe/sup 7+/ are calculated in the close-coupling and distorted-wave approximations. Coupling effects, beyond the first-order perturbation included in the distorted-wave approximation, are found to decrease rapidly as one moves to higher Z along the potassium isoelectronic sequence. Only for Fe/sup 7+/, however, are the close-coupling and distorted-wave results in agreement to 10% or better for all the excitations studied.

20965 **Experimental cross sections for electron-impact ionization of chromium ions: Cr/sup 6+/, Cr/sup 7+/, Cr/sup 8+/, and Cr/sup 10+/.** Sataka, M.; Ohtani, S.; Swenson, D.; Gregory, D.C. (Department of Physics, Japan Atomic Energy Research Institute, Tokai-mura, Ibaraki, 319-11 Japan). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2397-2403(1 Mar 1989).

Absolute cross sections have been measured from below threshold to 1500 eV for electron-impact single ionization of chromium ions in initial charge states 6+, 7+, 8+, and 10+. The measurements utilized the Oak Ridge National Laboratory Electron Cyclotron Resonance ion source and electron-ion crossed-beams apparatus. The lowest three charge states, which have $3s^23p$/sup n/ ground-state electron configurations, all exhibit ionization onsets at lower energies than expected for ground-state ions, indicating the presence of ions in metastable configurations in the incident beams. Significant contributions to the total cross sections by excitation autoionization are observed for each ion. The present measurements are compared to calculations of direct ionization from the Lotz formula, and the Cr/sup 10+/ measurements are compared to previous data for the isoelectronic ion Ni/sup 14+/.

20966 **Theoretical investigation of the hypothesized crossing between the Penning and atomic autoionizing states of He+K.** Padial, N.T.; Martin, R.L.; Cohen, J.S.; Lane, N.F. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2715-2717(1 Mar 1989).

The Penning ionization interaction $He(12s^3S)+K(3p^64s)$ and the atomic autoionizing state interaction $He(1s^2)+K(3p^64s^2)$ have been determined in a configuration-interaction calculation utilizing a basis set designed to treat these two states equitably. In contrast to an earlier calculation, the corresponding two potential curves are found not to cross. This finding puts in question the original speculation that the observed large He/sup */+K ionization cross section is due partially to collisional excitation of atomic states that subsequently autoionize. However, the calculated Penning ionization cross section is still in agreement with the experimental measurement.

20967 **Zero degree cross section for the reaction /sup 14/C(p,n) /sup 14/N/sub 2.31/, /sup 14/N/sub 3.95/ at 200, 300, and 450 MeV.** Alford, W.P.; Helmer, R.; Abegg, R.; Celler, A.; Frekers, D.; Haeusser, O.; Henderson, R.; Hicks, K.; Jackson, K.P.; Jeppesen, R.; and others. (Physics Department, University of Western Ontario, London, Ontario, Canada N6A3K7). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 1189-1192(Mar 1989).

We have measured the zero degree cross sections for the / sup 14/C(p,n) reaction leading to the (2.31+3.95) MeV states in / sup 14/N at energies of 200, 300, and 450 MeV. Cross sections for the Fermi transition to the 2.31 MeV state and for the Gamow-Teller transition to the 3.95 MeV state have been extracted using earlier measurements of the cross-section ratios. The results are compared with calculations using G-matrix effective interactions based on the Paris potential, and on one of the Bonn potentials, and a t-matrix effective interaction derived from nucleon-nucleon phase shifts. The best fit to both the present results and earlier results at lower energies is provided by calculations based on the Bonn potential.

20968 **Non—Franck-Condon effects induced by orbital evolution and Cooper minima in excited-state photoionization of OH.** Stephens, J.A.; McKoy, V. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). *Physical Review Letters;* **62**: No. 8, 889-892(20 Feb 1989).

We show that strong non—Franck-Condon effects can arise from photoionization of molecular Rydberg orbitals which evolve rapidly with internuclear distance and display Cooper minima in their photoelectron spectrum. The non—Franck-Condon mechanism should be most pronounced in excited-state photoionization of diatomic hydrides. The mechanism is illustrated with specific ab initio predictions of ion vibrational distributions for a proposed (3+1) one-color or (2+1)= two-color resonant multiphoton ionization measurement of OH via the $D^2\Sigma^-(1\pi^25\sigma)$ state.

20969 **Collision strengths and oscillator strengths for inner-shell excitation of Na-like ions.** Zhang, H.L.; Sampson, D.H.; Clark, R.E.H.; Mann, J.B. (Department of Astronomy, The Pennsylvania State University, University Park, Pennsylvania 16802). *Atomic Data and Nuclear Data Tables;* **41**: No. 1, 1-58(Jan 1989).

Collision strengths are given for the fine-structure transitions involving $1s^22s^22p^63l\text{-}1s^22s^22p^53l'3l''$ and $1s^22s^22p^63l\text{—}1s^22s2p^63l'3l''$ in 10 Na-like ions with nuclear charge number Z in the range $22 \leqq Z \leqq 62$. Electric dipole oscillator strengths obtained with various methods are also given. Neither l′ nor l″ need equal l because both configuration mixing and mixing of intermediate-coupling type among all states with the same set of n values, parity, and J value are included in the calculations. For each transition the results for the collision strength are given for the five impact-electron energies in threshold units X = 1.0, 1.5, 2.5, 6.0, and 15.0. The upper levels of these transitions can radiatively decay, which produces satellite lines to those due to the n = 3 to n = 2 transitions in neon-like ions, or they can autoionize, which populates the $1s^22s^22p^6\ ^1S_0$ ground level of neon-like ions. copyright 1989 Academic Press, Inc.

20970 **Dielectronic satellite spectra for neon-like ions.** Nilsen, J. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Atomic Data and Nuclear Data Tables;* **41**: No. 1, 131-177(Jan 1989).

The wavelengths, radiative transition rates, Auger rates, satellite intensity factors, and fluorescence yields are presented for dielectronic satellites of 14 neon-like ions ranging from Ar/sup 8+/ to W/sup 64+/. Dipole transitions from 2-barl-bar3l3l′ → 2l″ are all included. In this work, relativistic multiconfiguration wave functions are used to calculate energy levels as well as the Auger and radiative matrix elements. copyright 1989 Academic Press, Inc.

20971 **Contributions of autoionizing resonances to the n = 2-2 electron collisional excitation rates for Be-like ions.** Chen, M.H.; Crasemann, B. (High Temperature Physics Division, University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Atomic Data and Nuclear Data Tables;* **41**: No. 1, 59-69(Jan 1989).

The contributions of autoionizing resonances to the electron-impact excitation-rate coefficients for the n = 2 to n = 2 transitions in Be-like ions have been evaluated for six ions with atomic numbers Z = 30, 34, 36, 42, 47, and 54. The calculations were carried out in the isolated-resonance approximation. Interference between direct and resonance channels was neglected. The detailed Auger and radiative rates were computed using the multiconfiguration Dirac-Fock model. Results for the 45 transitions among 10 states from $1s^22l2l'$ configurations are listed. For electric-dipole-allowed transitions, the contributions from the autoionizing resonances are quite small. However, the autoionizing resonances can enhance the excitation rates by a factor of 2 to 4 for dipole-forbidden transitions. copyright 1989 Academic Press, Inc.

20972 **Cross Sections for K-shell X-ray Production by Hydrogen and Helium Ions in Elements from Beryllium to Uranium.** Lapicki, G. (Department of Physics, East Carolina University, Greenville, North Carolina 27858). *Journal of Physical and Chemical Reference Data;* **18**: No. 1, 111-218(Jan 1989).

Experimental cross sections for K-shell x-ray production by hydrogen and helium ions (Z_1 = 1,2) in target atoms from beryllium to uranium (Z_2 = 4—92) are tabulated as compiled (7418 cross sections) from the literature (161 references were found) with the search for the data terminated in January 1988. These cross sections are compared with predictions of the first Born approximation and ECPSSR theory for inner-shell ionization. The ECPSSR accounts for the energy loss (E) and Coulomb deflection (C) of the projectile ion as well as for the perturbed stationary state (PSS) and relativistic (R) nature of the target's inner-shell electron.While the first Born approximation generally overestimates the data by orders of magnitude, the ECPSSR theory is confirmed to be, on the average, in agreement with the experiment to within 10%—20%. For light and heavy target atoms, however, systematic and opposite deviations are found in the low projectile-velocity regime. These deviations are associated with the influence of multiple outer-shell ionizations on the fluorescence yields of light elements, particularly in ionization by helium ions, and with the inaccuracy of the ECPSSR theory in the reproduction of relativistic calculations for ionization of heavy elements. The remaining discrepancies at moderate projectile velocities are prima facie attributed to inadequacies of a screened hydrogenic description for the K-shell electron.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 19306, 20185

20973 **(IC—88/140) MHD forced and free convection boundary layer flow near the leading edge.** Hossain, M.A.; Ahmed, M. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1988. 20p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705974/JAW.

Magnetohydrodynamic forced and free convection flow of an electrically conducting viscous incompressible fluid past a vertical flat plate with uniform heat flux in the presence of a magnetic field acting normal to the plate that moves with the fluid has been studied near the leading edge of the plate. The coupled non-linear equations are solved by the method of superposition for the values of the Prandtl number ranges from 0.01 to 10.0. The velocity and the temperature profiles are presented graphically and the values of the wall shear-stress as well as the heat transfer rate are presented in tabular form showing the effect of the buoyancy force and the applied magnetic field. To show the accuracy of the present method some typical values are compared with the available one. (author). 17 refs, 3 figs, 2 tabs.

20974 **(INIS-mf—11374) /sup 3/He-/sup 4/He II mixtures. Thermodynamic and hydrodynamic properties.** Kuerten, J.G.M. (Technische Univ. Eindhoven (Netherlands)). 18 Sep 1987. 142p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706072/JAW.

Includes Dutch summary.

A theoretical study of the thermodynamic and hydrodynamic properties of /sup 3/He-/sup 4/He II mixtures at temperatures below 250 mK is described. A hydrodynamic model is set up which incorporates mutual friction between the two components. Results of an investigation into the quantitative calculation of the mutual friction are reported. 148 refs.; 34 figs.; 4 tabs.

20975 **(PNL—4348-Vol.1-Rev.2) TEMPEST: A three-dimensional time-dependence computer program for hydrothermal analysis: Volume 1, Numerical methods and input instructions: Revision 2.** Trent, D.S.; Eyler, L.L. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1989. Contract AC06-76RL01830. 280p. Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, WA 99352.

TEMPEST offers simulation capabilities over a wide range of hydrothermal problems that are definable by input instructions. These capabilities are summarized by categories as follows: modeling capabilities; program control; and I/O control. 10 refs., 22 figs., 2 tabs. (LSP)

20976 **Implosion and shock compression of two-dimensional eddy structures.** Viecelli, J.A. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids A: Fluid Dynamics;* **1**: No. 4, 753-757(Apr 1989).

Integration of the compressible Navier—Stokes equations shows that large amplifications of eddy kinetic energy are possible during the cylindrical implosion of two-dimensional randomized eddy structures. In the limit of vanishingly small initial eddy kinetic energy and viscosity, the amplification of the kinetic energy, and the density fluctuations associated with the eddies, is consistent with assumption that the angular momentum of individual eddies is conserved during the implosion. With increasing initial eddy kinetic energy, nonlinear effects reduce the amplification by a factor approximately exponential in the product of the compression and the ratio of the initial eddy kinetic energy to the implosion kinetic energy.

20977 **Fermion Monte Carlo algorithms and liquid ^{3}He.** Panoff, R.M.; Carlson, J. (Department of Physics and Astronomy, Kinard Laboratory of Physics, Clemson University, Clemson, South Carolina 29634-1911). *Physical Review Letters;* **62**: No. 10, 1130-1133(6 Mar 1989).

Variational Monte Carlo and several many-fermion Green's-function Monte Carlo (GFMC) algorithms are used to study the ground state of liquid ^{3}He. We report the first mirror potential GFMC calculations in a many-fermion problem, comparing them with transient estimation and fixed-node studies to illustrate the strengths and weaknesses of each. GFMC results with the Aziz HFDHE2 interaction are in good agreement with experiment, yielding energies within approximately 0.1 K per particle. In addition, each of these calculations predict a kinetic energy per particle of between 12 and 12.5 K.

20978 **Optimal initial condition for lattice-gas hydrodynamics.** Chen, S.; She, Z.; Harrison, L.C.; Doolen, G.D. (Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **39**: No. 5, 2725-2727(1 Mar 1989).

A method for minimizing the unphysical oscillations in simple lattice-gas hydrodynamic models is presented. Numerical simulations of two types of shear flows are reported that illustrate the usefulness of this method.

20979 **Theory of deep inelastic neutron scattering. II. Application to normal and superfluid ^{4}He.** Silver, R.N. (Theoretical Division, Los Alamos Neutron Scattering Center, MS B262, Group T-11, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4022-4029(1 Mar 1989).

The hard-core perturbation theory (HCPT) predictions for high-momentum-transfer neutron scattering from liquid ^{4}He are numerically evaluated. The input to the calculations are Monte Carlo and variational momentum distributions, the radial distribution function, and the Jeffreys-Wentzel-Kramers-Brillouin phase shifts for the He potential. Consistent with the ω^2 sum rule, the Gaussian width of the dynamic structure function $S(Q,\omega)$ is the same in HCPT and in the impulse approximation (IA). However, where the IA predicts structure in $S(Q,\omega)$ below T/sub λ/ due to the Bose condensate, HCPT predicts that $S(Q,\omega)$ is smoothed by final-state broadening. The final-state effects are negligible for the normal fluid above T/sub λ/. The approach to the IA at high Q is shown to be O(logQ) for the He-He potential, which implies that $S(Q,\omega)$ satisfies approximate Y scaling and that final-state broadening is significant for all feasible experiments. Extensions of HCPT to lower Q and to other systems are qualitatively discussed. The problem of extracting momentum distributions in quantum fluids and solids from high-Q neutron scattering is addressed.

20980 **^{3}He as an almost-localized Fermi liquid: The superfluid transition temperature.** Rasul, J.W.; Li, T.; Beck, H. (Physics Department, Temple University, Philadelphia, Pennsylvania 19122). *Physical Review [Section] B: Condensed Matter;* **39**: No. 7, 4191-4196(1 Mar 1989).

We examine the superfluid instability of liquid ^{3}He from the standpoint of the almost-localized theory, based on the Gutzwiller approximation to the Hubbard model. Using the boson representation of Kotliar and Ruckenstein [Phys. Rev. Lett. 57, 1362 (1986)], we calculate the equal-spin two-particle vertex to first order in a loop expansion. We extract the $l = 1$ coupling constant as a function of pressure and obtain values within 20% of the experimental ones. The choice of a cutoff proportional to the effective bandwidth leads to results for T/sub c/ in reasonably good agreement with experiments on liquid ^{3}He under pressure.

20981 **Hydrodynamics of water droplets irradiated by a pulsed CO_2 laser.** Zardecki, A.; Pendleton, J.D. (Los Alamos National Laboratory, Theoretical Division, Los Alamos, New Mexico 87545). *Applied Optics;* **28**: No. 3, 638-640(1 Feb 1989).

Using the notion of a source function, which describes the power deposited inside irradiated particles, we study the internal motion of irradiated water droplets by an intense laser pulse. The spatial distribution of the absorbed energy allows us to investigate 2-D hydrodynamic motion of the droplet. We find shock waves within the droplet and jets of vaporized material moving into the surrounding medium.

6450 High Energy Physics

20982 **(FNAL/C—88/110) Trieste conference on digital microelectronics and microprocessors in particle physics: Summary and concluding remarks.** Nash, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1988. Contract AC02-76CH03000. 5p. (CONF-8803123—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007484/JAW.

From International conference on the impact of digital microelectronics and microprocessors on particle physics; Trieste, Italy (28 Mar 1988).

This paper is a written version of the Concluding Remarks presented at the International Conference on the Impact of Digital Microelectronics and Microprocessors on Particle Physics. The Conference emphasized on-line data acquisition and triggering problems in high energy physics. Among the participants there was a clearly growing consensus that as these real time systems become larger they require more attention from the beginning to overall system coherence and manageability issues. We consider what this means for SSC/LHC era detectors. Given the interesting results on pixel silicon, neural networks, and parallel microprocessor based computers presented at Trieste, we speculate on some surprisingly simple, though still very radical, ideas on systems solutions for those huge detectors.

20983 **(FNAL/C—88/111) The Fermilab Advanced Computer Program multi-array processor system (ACPMAPS): A site oriented supercomputer for theoretical physics.** Nash, T.; Areti, H.; Atac, R.; Biel, J.; Cook, A.; Deppe, J.; Edel, M.; Fischler, M.; Gaines, I.; Husby, D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1988. Contract AC02-76CH03000. 8p. (CONF-8803123—5). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007485/JAW.

From International conference on the impact of digital microelectronics and microprocessors on particle physics; Trieste, Italy (28 Mar 1988).

The ACP Multi-Array Processor System (ACPMAPS) is a highly cost effective, local memory parallel computer designed for floating point intensive grid based problems. The processing nodes of the system are single board array processors based on the FORTRAN and C programmable Weitek XL chip set. The nodes are connected by a network of very high bandwidth 16 port crossbar switches. The architecture is designed to achieve the highest possible cost effectiveness while maintaining a high level of programmability. The primary application of the machine at Fermilab will be lattice gauge theory. The hardware is supported by a transparent site oriented software system called CANOPY which shields theorist users from the underlying node structure. 4 refs., 2 figs.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 21155, 21158

20984 **(ANL/PPRNT—89-163) Experimental limits on massive neutrinos from e$^+$ e/sup {minus}/ annihilations at 29 GeV.** Akerlof, C.; Chapman, J.; Errede, D.; Ken, M.T.; Meyer, D.I.; Neal, H.; Nitz, D.; Thun, R.; Tschirhart, R.; Derrick, M. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008360/JAW.

A search was made in 29 GeV e$^+$ e/sup {minus}/ annihilations for massive neutrinos decaying to e/sup +-/X/sup {minus←plus}/(ν) where X is a muon or meson. A 300 pb/sup {minus}1/ data sample yielded just one candidate event with a mass m/sub ex/ $>$ 1.8 GeV. Significant limits are found for new neutrinos with masses from 1.8 to 6.7 GeV and with mixing parameters in the range 10/sup {minus}6/ $<$ chemical bondUchemical bond^2 $<$ 1. 12 refs., 4 figs.

20985 **(CBPF-NF—032/86) Measurement of the D/sup +/ and D/sup 0/ lifetimes.** Anjos, J.C.C. dos; Appel, J.A.; Bracker, S.B. and others. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1986. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705399/JAW.

We have used a silicon microstrip vertex detector with Tagged Photon Spectrometer to measure the lifetimes of charmed mesons produced by a high energy photon beam at Fermilab. The D/sup +/ lifetime, based on 969 D/sup +/ -> K/sup -/PI/sup +/PI/sup +/ decays, is measured to be (1.06 +- 0.5 +- 0.3) x 10/sup -12/s. Using 1360 D/sup 0/ decays into the modes K/sup -/PI/sup +/ and K/sup -/PI/sup +/PI/sup -/PI+, we determine the lifetime to be (.435 +-.015 +-.010) x 10/sup -12/s. The ratio tau (D/sup +/)/ tau (D/sup 0/) obtained from these two measurements is (2.44 +-.14 +-.08).

20986 **(CEA-CONF—9453) Prospects on PI/sup 0/ and eta decays at Saturne.** Mayer, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie). 1988. 10p. (CONF-8803108—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756986/JAW.

From Workshop on production and decay of light mesons; Paris, France (3 Mar 1988).

Intense tagged beams of π/sup 0/ and eta can be produced at Saturne and used to study rare decays of these mesons. Experimental problems are discussed in the case of decays into two charged particles.

20987 **(CENBG—8727) Indication of neutrinoless double beta decay of /sup 76/Ge to the first excited state of /sup 76/Se. Results of the FREJUS experiment.** Busto, J.; Dassie, D.; Hubert, P.; Larrieu, P.; Leccia, F.; Mennrath, P.; Chevallier, J.; Larrea, A.; Morales, A.; Morales, J. and others. (Bordeaux-1 Univ., 83 - Gradignan (FR). Centre d'Etudes Nucleaires; Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Zaragoza Univ. (ES). Dept. de Fisica Nuclear). (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757193/JAW.

Neutrinoless double beta decay of Ge76 was studied. A coincidence cascade of 13 +- 5 counts between a 1483.6 +- 0.5 keV Ge energy deposition and a 559 +- 15 geV NaI energy deposition is observed, in agreement with the expected energies of 1482.3 +- 0.5 keV and 559.1 +- 0.I keV. No other unidentified cascade is seen in the full GeNaI matrix and no explanation within the background analysis is found. These features suggest the possibility of

neutiniless double beta decay of Ge76 to the first excited state of Se76 with a half life of 10/sup 22/ yr. Such a half life based on a signal at the 2.5 σ level does not appear to contradict the 1 σ level limits previously proposed.

20988 **(DOE/ER/01428—566) Review of results from CESR [Cornell Electron Storage Ring] and DORIS [DOpple RIng Spiecher].** Shibata, E.I. (Purdue Univ., Lafayette, IN (USA)). 1989. Contract AC02-76ER01428. 23p. (CONF-8811175—1; PU—89-626). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007365/JAW.

From Beyond the standard model; Ames, IA, USA (18 Nov 1988).

Selected results from e$^+$ e/sup {minus}/ colliding beam experiments operating in the $\sqrt{s} \sim$ 10 GeV region are reviewed. Photon and $\pi\pi$ transitions from the Y(1S), Y(2S), and Y(3S) bound states have been used to study the spectroscopy of the b{bar b} system. The Y(4S), which decays almost exclusively to B{bar B}, has been used to search for rare exclusive decay modes of B mesons and to measure B^0{bar B}^{0} mixing. Searches for the Higgs particle have been made in Y and B decays. 43 refs., 13 figs., 2 tabs.

20989 **(DOE/ER/40291—3) Unusual initial and final state effects in quantum chromodynamics: Annual performance report, July 15, 1988--February 20, 1989.** Nelson, C.A. (State Univ. of New York, Binghamton (USA). Dept. of Physics). Feb 1989. Contract FG02-86ER40291. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008229/JAW.

We have constructed symmetry tests from spin correlations functions in the sequential decay of a spin-0, or spin-1, boson into a fermion-antifermion pair such as {tau}$^+${tau}/sup {minus}/. A technipion and a Higgs boson can be distinguished by a 10--20% accuracy measurement of the observed leptons' energy-energy correlation function I(E_1, E_2, cos {psi}$_{12}$) = S + γ/sub CP/ D for the {bar {tau}}{tau} decay mode with {tau}/sup +-/ $\rightarrow$ {ell}/sup +-/ ν{bar {nu}}. A much stronger signature occurs for H $\rightarrow$ t{bar t} with t $\rightarrow$ b$\mu^+\nu$, t $\rightarrow$ {bar b}μ/sup {minus}/ν, because if the b jet's momenta are also measured, the necessary t and {bar t} rest frame variables can be determined. The harder lepton's energy spectrum for the decay sequence Z/sup o/ $\rightarrow$ {tau}$^+${tau}/sup {minus}/ $\rightarrow$ μ^+e/sup {minus}/ X is sensitive to the tau coupling parameters ξ and α/sub H/ where ξ is the Michel polarization parameter for {tau}/sup {minus}/ $\rightarrow$ γ/sup {minus}/$\nu\nu$/sup {minus}/, and α/sub H/ $\cong$ 2a/sub {tau}/ v/sub {tau}//(a/sub {tau}/^{2} + v/sub {tau}/^{2}) where a/sub {tau}/, v/sub {tau}/ describe Z/sup o/ $\rightarrow$ {tau}$^+${tau}/sup {minus}/ at tree level. The parameters ξ and α/sub H/ are independently determined. Due to a factorization property, radiative correction to such energy-energy correlations are as tractable as for A/sub LR/. By including two body modes, {tau}/sup {minus}/ $\rightarrow$ A/sup {minus}/ν for A = π, K, {rho}, K*, a_1, the ideal statistical error for α/sub H/ is reduced to $\sigma(\alpha$/sub H/) = 0.005, or a 0.3% error on sin $^2\theta$/sub w/. The chiral polarization parameters, ξ/sub A/, can also, be independently determined from I(E/sub A/, E/sub B/). 6 refs.

20990 **(DOE/ER/40370—2) Theory of photon and electron induced reactions: Progress report, July 1, 1988--June 30, 1989.** Onley, D.S.; Wright, L.E. (Ohio Univ., Athens (USA). Dept. of Physics and Astronomy). Mar 1989. Contract FG02-87ER40370. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008054/JAW.

During the first twenty months of our new grant from the Department of Energy we have made considerable progress or have completed our studies on the following aspects of the general investigation of electron and photon induced reactions: photo- and electro-production of mesons; the radiation tail accompanying elastic electron scattering and pair production; and studies involving the relativistic shell model. We will report on each of these developments in the following sections.

20991 **(INFN/AE—88-10) Probing the standard model at the SPS collider. Experimental results from UA1.** Bettini, A. (Istituto Nazionale di Fisica Nucleare, Padua (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 42p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705499/JAW.

A review of the experimental results which have been obtained by the UA1 experiment at the CERN proton-antiproton collider is presented. When relevant, results from the parallel UA2 experiment are quoted for comparison. Both experiments collected data in a series of data taking periods between 1982 and 1985 at centre of mass energies $\sqrt{s}$=546 GeV and, mostly, at $\sqrt{}$=630 GeV. The total integrated luminosity is between 0.7 and 0.8 events per picobarn (pb/sup -1/). The experimental results are compared with the predictions of the Electroweak theory and of the quantum Cromo-Dynamics. The observation of the W in all the three expected leptonic channels (W->eν/sub e/, W->$\mu\nu$/sub μ/, W->tauν/sub tau/) and of the Z/sup 0/ in both the electron and muon channels (Z/sup 0/->e/sup +/e/sup -/, Z/sup 0/->μ/sup +/μ/sup -/) are reviewed as well as the measurements of their masses and decay properties. Complete agreement is found with the predictions of the Electroweak theory. The production properties of the intermediate vector bosons (production cross section and differential cross sections) are found in agreement with the prediction of QCD. 33 refs.

20992 **(INFN/AE—88-11) Identification of semileptonic decay of T quarks produced at LEP-II.** Gobbo, B.; Rolandi, L. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705500/JAW.

Some selection criteria to identify the production of t-anti t pairs in the e/sup +/e/sup -/ interaction in the case that the production threshold for this process is below that of W/sup +/W/sup -/ pairs are discussed. Since the mass of the top quark is expected to be in the range 44 GeV<m/sub t/<200 GeV there is chance that it is lighter than the W. In this case it can be produced with the LEP machine when its centre of mass energy will be increased up to the W/sup +/W/sup -/ threshold. The identification of heavy quark production in e/sup +/e/sup -/ interaction has already been studied. A new criterion based on the identification of the semileptonic decay of the top quark is presented. These events, that have a very peculiar topology, can be also used to measured the mass of the quark.

20993 (INIS-BR—1424, pp 12) **Charm hadroproduction: status report on experiment E-769 at Fermilab.** Santoro, A.F.S. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20994 (INIS-BR—1424, pp 12) **Charm photoproduction: recent results from experiment E-691.** Anjos, J.C.C. dos. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20995 (INIS-BR—1424, pp 12) **Simple diffraction dissociation in PI /sup +/, k/sup +/ and p collisions in proton targets at 250 GeV/c - NAZZ Collaboration.** Endler, A.M.F.; Oliveira, L.C.S. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

20996 **(INIS-mf—11373) Charm production in two-photon collisions.** Linde, F.L. (Rijksuniversiteit Leiden (Netherlands)). 15 Sep 1988. 152p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706071/JAW.

Includes Dutch summary.

The analysis focuses on the production of charmonium resonances eta/sub c/, chi/sub 0/ and chi/sub 2/ in two-photon interactions. The measurement of the inclusive production of charged D* mesons is described. 97 refs.; 54 figs.; 15 tabs.

20997 **(INIS-mf—11902) DESY scientific annual report 1987.** (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1988. 292p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88757132/JAW.

This annual report contains a short description of the organization of DESY, extended abstracts concerning the experimental studies at the PETRA and DORIS storage rings, the development of the ZEUS detector, synchrotron-radiation experiments, theory of elementary particles, development of counting electronics, technical developments of the HERA, DORIS II and PETRA II storage rings and the DESY II respectively DESY I/III synchrotron, radiation protection, as well as data processing, and a list of speeches, publications, and theses. (HSI).

20998 **(JINR-D—1-88-194) Search for a nonstrange baryonium decaying into strange particles.** Aleev, A.N.; Aref'ev, V.A.; Balandin, V.P. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706094/JAW.

Inclusive production of a nonstrange baryonium decaying into strange particles has been searched for in the experiment performed in a neutron beam of the Serpukhov accelerator by means of the BIS-2 spectrometer. Final state characterized by a zero baryon number and strangeness, but containing strange particles and particles with a non-zero baryon number, have been studied. The invariant mass spectra: Λ/sup 0/p-barK/sup +/, Λ-bar/sup 0/ pK/sup -/, Λ/sup 0/p-barK/sup +/π/sup +-/, Λ-bar/sup 0/pK/ sup -/π/sup +-/ and K/sup 0/pp-barK/sup +-/ have been analyzed. In mentioned spectra narrow peaks ~30 MeV/c in width, which is close to the corresponding experimental resolution, are seen in a mass region of 3250 MeV/c/sup 2/. The obtained data indicate the existence of a narrow meson resonance with hidden quantum numbers: baryon number and strangeness. 14 refs.; 7 figs.

20999 **(KFK—4489) 4-jet events in the e/sup +/e/sup -/-annihilation.** Hahn, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Nov 1988. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757156/JAW.

With a cluster-algorithm and a invariant-mass routine we select 4-jet events form the data, which were taken with the CELLO-detektor at the PETRA storage ring at 35 GeV center-of-mass energy. We compare the 4-jet rate of the experimental data with monte-carlo data, which are based on second order perturbation theory, leading-log-approximation and optimized second order perturbation theory. Only the optimized second order QCD is able to describe the jet rates. We also study the opening angle distribution of the two lowest energy jets in the 4-jet events. In the monte-carlo data in second order QCD we see a difference between the angle distribution where gluon self-coupling was included and where it was not. The parton-shower model (LLA) yields the same angle distribution as the second order QCD.

21000 **(KFK—4490) Model independent study of the 3rd jet in the e/sup +/e/sup -/-annihilation.** Gabriel, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Dec 1988. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88757157/JAW.

Using data from the CELLO detector at the e/sup +/e/sup -/ storage ring PETRA we selected 3-jet events at the CMS-energie $\sqrt{s}$=35 GeV and 2-jet events at $\sqrt{s}$=14 GeV in e/sup +/e/ sup -/ annihilation with a cluster routine. We compared the p/sub perpendicular/ /sub to/-distribution and the fragmentation function of the 3rd jet around E/sub jet/=7 GeV at $\sqrt{s}$=35 GeV with that of the reference jet with E/sub jet/=7 GeV from the 2-jet events at $\sqrt{s}$=14 GeV. In this model independent comparison of gluon jet (3rd jet) and quark jet (ref jet) we found no jet broadening but a softer fragmentation function for the 3rd jet. Within our accuracy for <p/sub perpendicular/ /sub to//sup in/> and <p/sub perpendicular/ /sub to//sup out/> the 3rd jet is found to be round.

21001 **(LA—11491-T) Measurement of np elastic scattering spin-spin correlation parameters at 484, 634, and 788 MeV.** Garnett, R.W. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 284p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008409/JAW.

The spin-spin correlation parameters C/sub LL/ and C/sub SL/ were measured for np elastic scattering at the incident neutron kinetic energy of 634 MeV. Good agreement was obtained with previously measured data. Additionally, the first measurement of the correlation parameter C/sub SS/ was made at the three energies, 484, 634, and 788 MeV. It was found that the new values, in general, do not agree well with phase shift predictions. A study was carried out to determine which of the isospin-0 partial waves will be affected by this new data. It was found that the $^1P_1$ partial wave will be affected significantly at all three measurement energies. At 634 and 788 MeV, the $^3S_1$ phase shifts will also change. 29 refs., 21 figs., 16 tabs.

21002 **(LAL—88-17) Search for the top quark at the UA2 detector at the CERN proton-antiproton collider.** Moniez, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France)). Jun 1988. 232p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88757209/JAW.

The results of a search for the top quark, done in the UA2 experiment at CERN is presented in this thesis. The data from proton-antiproton collisions, at 546 and 630 GeV energy in the centre-of-mass system, representing a total integrated luminosity of 894 nb/sup -1/ accumulated by the UA2 detector, has been used. A signal coming from the semi-leptonic decay of the top quark (t decays to b + electron + neutrino) has been searched for in the event sample containing an identified electron associated with 0.1 or 2 jets. A detailed study of the experimental background coming from misidentified electrons has been made; furthermore, the standard sources of real electrons have been estimated using a simulation program. Taking into account these background evaluations, and using a top production Monte-Carlo, a statistical analysis of the events containing one electron and 2 jets allows us to discuss a lower limit on the top quark mass. An upper limit on top production through the process proton-antiproton goes to top-antitop is derived, as a function of the top mass, from our data. Extrapolating the background and production evaluations to UA2'indicates that this experiment should be sensitive to top masses below 70 GeV/c/ sup 2/.

21003 **(LAL—88-27) Analysis of multihadronic events produced with two energetic leptons in e/sup +/e/sup -/ annihilation.** ; CELLO Collaboration. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jun 1988. 12p. (DESY—88-086). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757210/JAW.

A search for multihadronic events produced with two energetic leptons was performed at PETRA using 130 pb/sup -1/ accumulated by the CELLO detector at $\sqrt{S}$=35 to 46.8 GeV. Three μ/sup +/ μ/sup -/, 11e/sup +/e/sup -/, and three eμ events were observed. The measured yields and event characteristics are in good agreement with the expectations from the α/sup 4/ QED processes e/sup +/e/sup 6/ ->1/sup +/1/sup -/q q bar and from semi leptonic decays of pairs of heavy quarks.

21004 **(LAL—88-31) Spectroscopy related to two photon physics.** Augustin, J.E. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1988. 23p. (CONF-8804245—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757025/JAW.

From 8. International workshop on Photon-Photon Collisions; Jerusalem, Israel (24 Apr 1988).

The status of light meson spectroscopy is reviewed, emphasizing subjects also studied in photon-photon collisions. Results on pseudo-scalar particles are presented, based on the study of J/PSI decays into three photons and into a pseudo-scalar and a vector. The status of the 1200-1600 MeV region for pseudo-scalar and axial vector particles is also reviewed, particularly the so-called E/iota states. For tensors, results for various states are reported, particu-

larly for the gluonium candidate f/sub 2/ (1720). Candidates for non quark-antiquark are presented, especially a 1/sup -+/eta π candidate from GAMS experiment.

21005 **(LBL—26465) Resonant production in two photon collisions.** Butler, F. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 107p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008168/JAW.

Using 220 picobarn/sup {minus}1/ of data collected by the Mark II detector at PEP, we have measured the width of the {eta}' for quasi real photons. The width is separately measured in the three reactions e$^+$e/sup {minus}/ $\rightarrow$ e$^+$e/sup {minus}/{eta}$^0\pi^+\pi$/sup {minus}/; {eta}^{0} $\rightarrow$ $\gamma\gamma$, e$^+$e/sup {minus}/ $\rightarrow$ e$^+$e/sup {minus}/{eta}$^0\pi^+\pi$/sup {minus}/; {eta}^{0} $\rightarrow$ $\pi^+\pi$/sup {minus}/($\pi^0\gamma$) and e$^+$e/sup {minus}/ $\rightarrow$ e$^+$e/sup {minus}/{rho}$^0\gamma$, giving a statistically weighted average two-photon width of Γ/sub {eta}'$\rightarrow\gamma\gamma$/ = 5. 21+-0.28 keV. As a by-product of the measurement of Γ/sub {eta}'$\rightarrow\gamma\gamma$/ using the decay mode {eta}' $\rightarrow$ {rho}γ, we also measured a two-photon decay width for the a_2(1320) of Γ/sub a 2(1320)$\rightarrow\gamma\gamma$/ = 1.17+-0. 15+-0.25 keV. 47 refs., 50 figs., 8 tabs.

21006 **(LBL—26561) Higgs $\rightarrow$ four leptons at the SSC.** Wang, E.M.; Hanson, G.G. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098. 11p. (CONF-8806243—33). NTIS, PC A03 - OSTI. Order Number DE89007498/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

Detection of an intermediate mass or heavy Higgs boson through its decay into four charged leptons is studied with emphasis on background considerations and detector requirements. The intermediate mass Higgs decay via ZZ* is expected to be a difficult mode to observe due to low event rates. In addition, cuts which are needed to reduce the backgrounds reduce the signal even further. The rapidity coverage and energy resolution requirements for this mode are more severe than for the heavy Higgs. The heavy Higgs boson decay H $\rightarrow$ Z^{0}Z^0 $\rightarrow$ 4{ell}/sup +-/ continues to be observable for a Higgs mass between twice the Z mass and about 600 GeV/c^2 when detector characteristics of generic large SSC detectors are included. A careful study is made of backgrounds from q{bar q}, qq $\rightarrow$ Z + Jets and detector-related issues. It is shown that an isolation cut on the lepton candidates can be expected to reduce the background from this source to low levels. 14 refs., 12 figs., 4 tabs.

21007 **(LBL—26728) Strangeness production in nucleus-nucleus collisions: Experimental summary.** Odyniec, G. (Lawrence Berkeley Lab., CA (USA)). Feb 1989. Contract AC03-76SF00098. 21p. (CONF-8810264—6). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008387/JAW.

From Conference on hadronic matter in collision; Tucson, AZ, USA (6 Oct 1988).

Rather than attempt to give a complete review of strangeness production in all kinds of experiments, I will dwell on the most interesting and promising aspects of the experimental results from nucleus-nucleus (A + A) experiments, using p + p/{bar p} + p and p + A/{bar p} + A data only as reference when needed. In this paper I will try: to identify the important features of the reaction mechanism; to understand the mechanisms; to learn about quark-gluon plasma formation by comparing nucleus-nucleus collisions with p-nucleus, {bar p}-nucleus, p + p and {bar p} + p collisions; to see if there is any definite evidence yet supporting quark-gluon plasma formation; and to suggest further needs for experimental and theoretical study. 32 refs., 8 figs.

21008 **(LPNHE—87-07) Neutrino oscillation study in the muon neutrino -> electron neutrino channel at the Brookhaven accelerator.** Astier, P. (Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies). Sep 1987. 179p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88757030/JAW.

The E816 experiment described in this thesis is devoted to a neutrino oscillation search at the Brookhaven AGS. The method used here is to look with a fine grained calorimeter for the appearence of electron neutrino in a muon neutrino beam. After recalling the theoretical treatment of the neutrino mass problem, the experimental phenomenology of massive neutrinos and more specifically neutrino oscillations is reviewed. The experiment itself is then extensively described, both on the technical side (detector, beam, simulation) and on the analysis side. In particular the statistical separation of the electromagnetic showers from electrons - our signal - and from photons - our background - treated in detail. The present analysis is based on 2/3 of the final statistics and it leads to the - preliminary - observation of an electron excess in the neutrino interactions yielding 19 +- 15.6 (stat) +- 7 (syst).

21009 **(NIKHEF-H—87-23) Charmonium production in photon-photon collisions. TPC/Two-gamma collaboration.** Aihara, H.; Alston-Garnjost, M.; Avery, R.E. and others; Lawrence Berkeley Lab. - California Univ. - Iowa State Univ. - John Hopkins Univ. - Massachussetts Univ. - NIKHEF - Tokyo Univ. Collaboration. (Tokyo Univ. (Japan); Lawrence Berkeley Lab., CA (USA)). (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 8 Dec 1987. 16p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706103/JAW.

The authors have searched for the two-photon production of the eta/sub c/, chi/sub 0/ and chi/sub 2/ charmonium states at the e/sup +/e/sup -/ collider PEP in the channels $\gamma\gamma$ -> K/sup +-/K/sub S//sup 0/π /sup +/, $\gamma\gamma$ -> K/sup +/K/sup -/π/sup +/π/sup -/, $\gamma\gamma$ -> π/sup +/π/sup -/π/sup +/π/sup -/ and $\gamma\gamma$ -> K/sup +/K/sup -/K/sup +/K/sup -/. They identify four eta/sub c/ candidates in the K/sup +/K/sup -/K/sup +/K/sup -/ channel on a negligible background; the one phiphi event among them implies a 95% C.L. lower limit for Γ/sub $\gamma\gamma$/(eta/sub c/) of 1.7 keV. In the other channels no evidence is found for any of the three states. 95% C.L. upper limits Γ/sub $\gamma\gamma$/(eta/sub c/) < 15.5 keV, Γ/sub $\gamma\gamma$/(chi/sub 0/) < 17.0 keV and Γ/sub $\gamma\gamma$/(chi/sub 2/) < 4.2 keV are established. From all channels combined the value Γ/sub $\gamma\gamma$/(eta/sub c/) = 6.4/sub -3.4//sup +5.0/ keV is obtained. PACS numbers: 14.40.Gx, 13.25. + m, 13.60.Le. 22 refs.; 3 figs.; 1 table.

21010 **(NIKHEF-H—88-3) Hard scattering of (almost) real photons at HERA.** Jong, S.J. de; Engelen, J.J. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). 18 Mar 1988. 27p. (CONF-8710308—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88706104/JAW.

From DESY [Deutches Electronen-Synchrotron] theory workshop on physics at HERA; Hamburg, F.R. Germany (12 Oct 1987).

High P/sub T/ photoproduction will play an important role at HERA, both as interesting physics in its own right and as a background. Photoproduction reactions producing large transverse momenta will be reviewed, as well as the possibility of using them for tests of perturbative QCD. Pointlike coupling of the photon to the proton constituents will be considered in detail in leading log approximation. Although the cross sections of these processes, photon gluon fusion and QCD Compton scattering, get their largest contribution from low Q/sup 2/ (almost) real photons, we calculate them over the full Q/sup 2/ range. Photoproduction as a background to the standard deep inelastic physics at HERA and to exotic phenomena is discussed. Heavy flavour production through photon gluon fusion may offer good possibilities of studying charm and bottom quarks. An attempt is made to determine a possible strategy to identify the top quark at HERA. 29 refs.; 20 figs.; 7 tabs.

21011 **(NIKHEF-H—88-6) Estimate of the rescattering fraction in neutrino- and antineutrino-deuteron interactions.** Tenner, A. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). May 1988. 14p. Library, KNAW; Joan Muyskenweg 25, 1096 CJ Amsterdam, Netherlands.

The rescattering fraction of the deuteron has been evaluated for neutrino and antineutrino interactions. Use has been made of 27575 ν and 16896 antiν events, observed in a bubble chamber ex-

periment. The obtained values: f=0.118+-0.003+-0.010 for ν and f=0.104+-0.007+-0.010 for antiν are in agreement with previously estimated values. 7 refs.; 3 figs.; 2 tabs.

21012 (SLAC—316, pp 5-17) **Testing quantum chromodynamics in electroproduction.** Brodsky, S.J. May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The main emphasis is in the study of exclusive channels in electroproduction. It is clearly interesting to study how the summation of such channels yields the total inelastic cross section. More important, each individual exclusive channel can provide detailed information on basic scattering mechanisms in QCD and how the scattered quarks and gluons recombine into hadrons. In certain cases such as Compton scattering and meson electroproduction, the authors can study new aspects of the light cone expansion for the product of two current, thus extending the renormalization group analysis into a new domain. The diffractive production of vector mesons at high Q^2 can test the basic composition of the Pomeron in QCD. Further, as they discuss in the next section, measuring exclusive reactions inside a nuclear target allows the study of color transparency, the formation zone, and other novel aspects QCD.

21013 (SLAC—316, pp 76-81) **Vector dominance revisited by a quark theorist.** Carlson, C.E. (College of William and Mary, Williamsburg, VA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The authors examine from the viewpoint of QCD some topics that are often treated at lower energies by other means, particularly vector meson dominance, VMD. They would like to see why the older methods worked well enough to be pursued and what limits QCD says they should tend toward at higher energies.

21014 (SLAC—316, pp 131-138) **How good is vector-meson dominance in the description of E.M. form factors of hadrons?.** Gari, M.F. (Institut fuer Theoretische Physik, Juelich (Germany, F.R.)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The quality of the vector-meson dominance approach is discussed in the description of electromagnetic form factors of nucleon and pion. A generalization of this approach is given which includes the constraints at high Q^2 as obtained from perturbative quantum chromodynamics. An interesting possibility in the interpretation of the analysis is that nucleon and pion are very different in their quark-gluon structure. The importance for measurements of the electric form factors of neutron and proton as well as the pion form factor is emphasized.

21015 (SLAC—316, pp 139-147) **Baryon resonances without quarks: a chiral soliton perspective.** Karliner, M. May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

In many processes involving low momentum transfer it is fruitful to regard the nucleon as a soliton or monopole-like configuration of the pion field. In particular, within this framework it is possible to obtain detailed predictions for pion-nucleon scattering amplitudes and for properties of baryon resonances. One can also derive model-independent linear relations between scattering amplitudes, such as πN and anti KN. A short survey of some recent results is given, including comparison with experimental data.

21016 (SLAC—316, pp 151-153) **Nuclear effects in electroproduction of hadrons.** Harindranath, A.; Vary, J.P.; Lassila, K.E. (California Institute of Technology, Pasadena (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The authors evaluate the possibility of observing nuclear effects in semi-inclusive electroproduction of hadrons(h) from nuclei. They assume factorization and nuclear independence of fragmentation functions in the current fragmentation region. Hence it is shown that the production ratio of oppositely charged hadrons h^+/h^- for the same nucleus is quite insensitive to nuclear effects and the ratio of cross sections for the production of the same sign hadron from different nuclei exhibit the same behavior as the inclusive ratio which is sensitive to nuclear effects.

21017 (SLAC—316, pp 159-161) **(e, e'π) and the pion nucleon formfactor.** Schaefer, A.; Koonin, S.E. (W.K. Kellogg Radiation, Pasadena, CA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

It has been claimed that the reaction e + rho $\rightarrow$ e' + π^+ + eta tests directly the pion content of the nucleon. Such a measurement would be very interesting as it could test some of the models proposed to explain the EMC effect. The authors argue that this claim is invalid and that the only information one can extract from such an experiment is the pion nucleon formfactor F/sub πNN/ (and the electromagnetic formfactor of the pion).

21018 (SLAC—316, pp 162-165) **Modification of nucleon properties in nuclei.** Shakin, C.M. (Brooklyn College of the City Univ. of New York (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Three topics of current interest in nuclear physics are the EMC effect, the quenching of the longitudinal response seen in inclusive (e,e') reactions, and the use of the Dirac equation to describe nucleon motion in nuclei. All are related to a single effect, the modification of the gluon condensate in nuclei. In all three cases mentioned above, the effects of a change of a QCD mass (or length) scale away from its vacuum value are being observed. The order parameter describing this scale change is an order parameter of the gluon condensate. In particular, it is shown how a length scale may be specified for QCD by making use of the gauge and Lorentz invariant parameter. The presence of quarks tends to break down the gluon condensate and in nuclear matter phi/sub o/ should be replaced by phi/sub NM < phi/sub o/. Indeed, if phi/sub o//phi/sub NM/ $\approx$ 1.25, the various phenomena mentioned above can be understood.

21019 (SLAC—316, pp 174-179) **Fresh look at Bose-Einstein correlations.** Hofmann, W. (Univ. of California, Berkeley, CA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Recent experimental data on Bose-Einstein (BE) correlations between identical bosons are reviewed, and new results concerning the interpretation of the BE enhancement are discussed. In particular, it is emphasized that the classical interpretation of the correlation function in terms of the space-time distribution of particle sources cannot be directly applied to particle production in high energy reactions.

21020 (SLAC—316, pp 186-189) **Exclusive and inclusive reactions with real and virtual photons to probe multi-quark effects.** Lassila, K.E.; Harindranath, A.; Vary, J.P. (Iowa State Univ., Ames (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The authors have examined many exclusive and inclusive reactions to conclude it best to project real or virtual photons on partons in a nucleus to probe the mechanism responsible for the EMC effect. Such reactions could be triggered on particles produced beyond usual (nucleon target) kinematical limits from quarks in e.g., multi-quark color singlet structures. They show that the multi-quark fragmentation function may be measurable in the quark (QCD or real) Compton effect.

21021 (SLAC—316, pp 190-194) **Pion electroproduction from nuclei and quark-pion nuclear interactions.** Stoler, P. (Rensselaer Polytechnic Institute, Troy, NY (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The theory of pion photo electroproduction is closely related to the authors understanding of fundamental processed involving elementary particles. At excitations below 2 GeV these reactions have provided much of their information about baryon resonances (Do-78). At higher excitations, in the scaling region they are directly related to the processes by which quarks hadronize. The study of these reactions are interesting in nuclei where one would like to learn about the influence of the nuclear environment on the elementary processes. In the past electro and photoproduction experiments on nuclei have been strongly limited by the parameters of existing electron accelerators, the most important of which are low energy and duty factor. The new generation nuclear physics facilities at CEBAF and PEP will complement each other in making possible programs of pion electroproduction not previously possible. CEBAF, with an eventual maximum energy of ~ 6 GeV, will cover the nucleon resonance region, through the transition to x scaling. PEP with a maximum energy of ~ 14 GeV is well suited for experiments in the x scaling and higher Q^2 region.

21022 **(SLAC—337) Tests of QED [Quantum Electrodynamics] to fourth order in alpha in electron-positron collisions at 29 GeV.** Hawkins, C.A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Feb 1989. Contract AC03-76SF00515. 106p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008406/JAW.

Tests of Quantum Electrodynamics to order {alpha}{sup 4} in e{sup +}e{sup {minus}} collisions using the ASP detector at PEP ({radical}s = 29 GeV) are presented. Measurements are made of e{sup +}e{sup {minus}} {yields} {gamma}{gamma}{gamma}{gamma}, e{sup +}e{sup {minus}} {yields} e{sup +}e{sup {minus}}{gamma}{gamma} and e{sup +}e{sup {minus}} {yields} e{sup +}e{sup {minus}}e{sup +}e{sup {minus}} where all four final state particles are separated from the beam line and each other. These are the most precise and highest statistics measurements yet reported for these processes. The ratios of measured to predicted cross sections are {gamma}{gamma}{gamma}{gamma}: 0.97 {plus←minus} 0.04 {plus←minus} 0.14 e{sup {+}e{sup {minus}}{gamma}gamma}: 0.94 {plus←minus} 0.03 {plus←minus} 0.03 e{sup +}e{sup {minus}}e{sup +}e{sup {minus}}: 1.01 {plus←minus} 0.02 {plus←minus} 0.04 where the first uncertainty is the systematic uncertainty, and the second is the statistical uncertainty. All measurements show good agreement with theoretical predictions. A Monte Carlo method for simulating multi-pole processes is also presented, along with applications to the e{sup +}e{sup {minus}} {yields} e{sup +}e{sup {minus}}{gamma}{gamma} and e{sup +}e{sup {minus}} {yields} {gamma}{gamma}{gamma}{gamma} processes. The first measurements of five-body {alpha}{sup 5} events ({sup 5}{gamma}, e{sup +}e{sup {minus}}{gamma}{gamma}{gamma} and e{sup +}e{sup {minus}}e{sup +} e{sup {minus}}{gamma}) and one candidate six-body {alpha}{sup 6}event (e{sup +}e{sup {minus}}4{gamma}) are reported. Both the {alpha}{sup 5} and {alpha}{sup 6} measurements agree with estimates of their cross sections. 20 refs., 34 figs., 14 tabs.

21023 **(TRI-PP—88-82) Radiative muon capture with the TRIUMF TPC.** Hasinoff, M.D.; Ahmad, S.; Armstrong, D.S.; Azuelos, G.; Blecher, M.; Burnham, R.A.; Clifford, E.T.H.; Depommier, P.; Gorringe, T.P.; Larabee, A.J. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1988. 3p. (CONF-880938—5). NTIS (US Sales Only), PC A02/MF A01 - OSTI. Order Number DE89007653/JAW.

From International symposium on mesons and light nuclei; Rez, Czechoslovakia (5 Sep 1988).

Radiative muon capture (RMC), μ/sup {minus}/Z $\rightarrow$ ν(Z{minus}1)$\gamma\gamma$, is a weak semileptonic process which is particularly sensitive to the induced pseudoscalar coupling constant, g/sub p/ , of the weak hadronic current. A program is underway at TRIUMF to measure the energy spectrum and branching ratio for RMC on hydrogen, to determine g/sub p/ for a free nucleon. As a precursor to the hydrogen measurement, and also to investigate possible renormalization of g/sub p/ in nuclei, RMC rates on ^{40}Ca, ^{16}O and ^{12}C were measured and are reported in this paper. 7 refs., 6 figs., 1 tab.

21024 **Σ/sub c//sup ++/ and Σ/sub c/^{0} production from e^+e^- annihilation in the Y energy region.** Bowcock, T.; Kinoshita, K.; Pipkin, F.M.; Procario, M.; Wilson, R.; Wolinski, J.; Xiao, D.; Jawahery, A.; Park, C.H.; Poling, R.; and others. (Harvard University, Cambridge, Massachusetts 02138). *Physical Review Letters;* **62**: No. 11, 1240-1242(13 Mar 1989).

We have observed Σ/sub c//sup ++/ and Σ/sub c/^{0} baryons in nonresonant e^+e^- interactions through their decays to Λ/sub c/$^+$ π/sup +- / using the CLEO detector. The mass difference M(Σ/sub c//sup ++/)-M(Λ/sub c/$^+$) is measured to be 167.8 +- 0.4 +- 0.3 MeV; for M(Σ/sub c/^{0})-M(Λ/sub c/$^+$) we find 167.9 +- 0.5 +- 0.3 MeV. Σ/sub c/ decay accounts for (18 +- 3 +- 5)% of Λ/sub c/$^+$ production.

21025 **Refined measurement of the B-hadron lifetime.** Ong, R.A.; Jaros, J.A.; Abrams, G.S.; Amidei, D.; Baden, A.R.; Barklow, T.; Boyarski, A.M.; Boyer, J.; Burchat, P.R.; Burke, D.L.; and others. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309). *Physical Review Letters;* **62**: No. 11, 1236-1239(13 Mar 1989).

We report a new measurement of the average lifetime of hadrons containing bottom quarks. The B-hadron decays are tagged by identifying leptons at high transverse momentum. From a fit to the lepton impact-parameter distribution, the average B-hadron lifetime is found to be (0.98 +- 0.12 +- 0.13) x 10/sup -12/ sec.

21026 **Measurement of W-boson production in 1.8-TeV p-barp collisions.** Abe, F.; Amidei, D.; Apollinari, G.; Ascoli, G.; Atac, M.; Auchincloss, P.; Baden, A.R.; Barbaro-Galtieri, A.; Barnes, V.E.; Bedeschi, F.; and others. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **62**: No. 9, 1005-1008(27 Feb 1989).

The cross section for the production and subsequent decay to electron and neutrino of the W intermediate vector boson has been measured in 1.8-TeV p-barp collisions at the Fermilab Tevatron Collider. An analysis of events with missing transverse energy greater than 25 GeV and with an electron of transverse energy greater than 15 GeV from a datum sample of 25.3 nb/sup -1/ gives σB = 2.6 +- 0.6 +- 0.5 nb.

21027 **Measurement of the spin-rotation parameters A and R for $\pi^+p\rightarrow\pi^+p$ and $\pi^-p\rightarrow\pi^-p$ scattering from 471 to 625 MeV/c.** Barlow, D.B.; Kessler, R.S.; Kim, G.J.; Nefkens, B.M.K.; Pillai, C.; Price, J.W.; Wightman, J.A.; Hall, S.; Lane, D.W.; Loe, S.R.; and others. (University of California, Los Angeles, California 90024). *Physical Review Letters;* **62**: No. 9, 1009-1012(27 Feb 1989).

The spin-rotation parameters A and R for π^+p and π^-p elastic scattering have been measured at pion momenta from 471 to 625 MeV/c using a frozen spin target polarized in the scattering plane and a recoil-proton polarimeter. Our results show that the major features of the recent πN partial-wave analyses (PWA's) are correct. This is the first time such confirmation has been possible. Some deviations outside the errors indicate the need for a new round of PWA's.

21028 **Observation of the charmed strange baryon γ/sub c/^{0}.** Avery, P.; Besson, D.; Garren, L.; Yelton, J.; Bowcock, T.; Kinoshita, K.; Pipkin, F.M.; Procario, M.; Wilson, R.; Wolinski, J.; and others. (University of Florida, Gainesville, Florida 32611). *Physical Review Letters;* **62**: No. 8, 863-865(20 Feb 1989).

We present evidence from the CLEO detector for the charmed strange baryon γ/sub c/^{0}. It is seen in nonresonant e^+e^- annihilations at $\sqrt{s}$ of 10.5 GeV through its decay to $\gamma^-\pi^+$. The measured γ/sub c/^{0} mass is 2471 +- 3 +- 4 MeV/c^2.

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REFER ALSO TO CITATION(S) 20396, 20397, 20917, 20999, 21103, 21136, 21137, 21138, 21414, 21417, 21430

21029 **(ANL-HEP-CP—88-26) Heavy flavor production.** Berger, E.L. (Argonne National Lab., IL (USA)). 10 Jun 1988. Contract W-31109-ENG-38. 29p. (CONF-8710276—6). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007416/JAW.

From Advanced research workshop on QCD hard hadronic processes; St. Croix, Virgin Islands, U.S. (8 Oct 1987).

Predictions are presented of total cross sections for charm and bottom quark production in {bar p}p, π/sup {minus}/p, and pp interactions at fixed target and collider energies. The calculations are done through next-to-leading order in QCD perturbation theory. The sensitivity is explored of results to the choices of renormalization/evolution scale, parton densities, Λ/sub QCD/, and heavy flavor masses. Comparisons with available data show that good agreement is obtained for reasonable values of charm and bottom quark masses and other parameters. Open issues in the interpretation of results are summarized including the large size of the next-to-leading order contributions, proper definition of the gluon density, the nuclear A dependence of charm cross sections, the role of final state interactions, and higher twist effects. 39 refs., 7 figs., 5 tabs.

21030 **(ANL-HEP-CP—88-92) Quarks and the spin of the proton for pedestrians.** Lipkin, H.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. (CONF-8808198—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007261/JAW.

From Excited baryons; Troy, NY, USA (4 Aug 1988).

The analysis of the EMC result on the quark contribution to the spin of the proton has caused considerable confusion and is unnecessarily complicated because of the use of SU(3) flavor symmetry to provide input on the proton wave function from hyperon decays. The basic physics can be seen by noting a clear inconsistency between the known result of the axial vector contribution to nucleon beta decay and the conventional quark-parton interpretation of the EMC result. 4 refs.

21031 **(ANL/PPRNT—89-158) Quark compound Bag model for NN scattering up to 1 GeV.** Fasano, C.; Lee, T.S.H. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 36p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008449/JAW.

A Quark Compound Bag model has been constructed to describe NN s-wave scattering up to 1 GeV. The model contains a vertex interaction H/sub D{leftrightarrow}NN/ for describing the excitation of a confined six-quark Bag state, and a meson-exchange interaction obtained from modifying the phenomenological core of the Paris potential. Explicit formalisms and numerical results are presented to reveal the role of the Bag excitation mechanism in determining the relative wave function, P- and S-matrix of NN scattering. We explore the merit as well as the shortcoming of the Quark Compound Bag model developed by the ITEP group. It is shown that the parameters of the vertex interaction H/sub D{leftrightarrow}NN/ can be more rigorously determined from the data if the notation of the Chiral/Cloudy Bag model is used to allow the presence of the background meson-exchange interaction inside Bag excitation region. The application of the model in the study of quark degrees of freedom in nuclei is discussed. 41 refs., 6 figs., 3 tabs.

21032 **(DOE/ER/40265—20) Lattice Higgs.** Neuberger, H. (Rutgers--the State Univ., Piscataway, NJ (USA)). 1988. Contract FG05-86ER40265. 9p. (CONF-8808185—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007465/JAW.

From Meeting on frontiers of nonperturbative field theory: Lattice fields and strings; Eger, Hungary (18 Aug 1988).

The implications of $\lambda\{phi\}^4$ triviality for the standard model are reviewed. The general framework and the techniques for obtaining an upper bound on the Higgs mass are discussed. 19 refs.

21033 **(FNAL/C—89/20) Micro-review of structure functions and parton distribution functions.** Morfin, J.G. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1989. Contract AC02-76CH03000. 21p. (CONF-8809223—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007482/JAW.

From Workshop on new directions in neutrino physics; Batavia, IL, USA (14 Sep 1988).

There has recently been a great deal of discussion concerning the surprising differences in the measurements of the nucleon structure function $F_2(x,Q^2)$, off of a hydrogen target, by the high statistics muoproduction experiments EMC and BCDMS. In this short review I will attempt to summarize the status of the experimental measurements of the structure functions and highlight any significant disagreements. At the conclusion I will comment on the status of the extraction of the parton distribution functions from these measurements. 17 refs., 16 figs., 2 tabs.

21034 **(IC—88/223) Phenomenological and approximately flavour independent potential for quark-antiquark system.** Song Xiaotong. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 29p. (CONF-880867—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705655/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

We proposed a phenomenological and flavour independent potential for quark-antiquark systems with equal or unequal masses. The potential has a Lorentz vector term motivated by empirical formula of leptonic width of vector meson at short distances and a Lorentz scalar part inspired by the result from lattice QCD responsible for quark confinement at large distances. Using this potential we calculated the energy levels, leptonic widths, radiative transition rates and hadronic decay rates of the (uu-bar), (dd-bar), (ss-bar), (cc-bar), (bb-bar) and (tt-bar) systems. The fine and hyperfine splittings of light and heavy quark-antiquark systems are also calculated. Most results agree fairly well with the experiment. (author). 46 refs, 5 figs, 13 tabs.

21035 **(IC—88/236) New approach to SU/sub 2L/xU/sub 1/ radiative corrections in e/sup +/e/sup -/ annihilation processes near the Z/sup 0/ resonance.** Jadach, S.; Ward, B.F.L. (Stanford Univ., CA (USA)). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 12p. (UTHEP—88-020(Rev.)). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705977/JAW.

We show explicitly how to proceed in the Monte Carlo simulation of SU/sub 2L/xU/sub 1/ radiative corrections in order to include multiple soft photon emission on an event by event basis. The method is based on the rigorous theory of summing infrared contributions to the respective cross section by Yennie, Frautschi and Suura. Our method is illustrated on the example of initial state bremsstrahlung. (author). 10 refs, 2 figs.

21036 **(IC—88/362) Numerical analysis of the high energy behaviour of the baryon-baryon scattering amplitude in a spontaneously broken gauge theory of the vector meson exchange.** Raczka, P.A.; Pindor, M. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 25p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705993/JAW.

The baryon-baryon scattering amplitude at large s and small t is considered in a spontaneously broken non-Abelian gauge theory model of the vector meson exchange. A numerical procedure is proposed to obtain the asymptotic behaviour of this amplitude, which in the leading logarithm approximation is determined by an integral equation. Calculations performed for t=0 confirm that a rising total cross section is obtained, but exact asymptotic form is different from that found by other authors. Resulting expression for the total cross section is compared with the experimental data on the high energy pp pp-bar scattering. (author). 20 refs, 2 figs, 3 tabs.

21037 (ICEFIZ-HE—114-1988) **Multi-quark effects in high energy nucleon-nucleon and nucleus-nucleus collisions.** Besliu, C.; Caraciuc, I.; Jipa, A.; Olariu, A.; Topor-Pop, R.; Cotorobai, F.; Pantea, D.; Popa, L.; Popa, V.; Topor-Pop, V. (Bucharest Univ. (Romania); Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania); Centrul de Cercetare si Perfectionarea Cadrelor diu Economie, Bucharest (Romania)). (Central Inst. of Physics, Bucharest (Romania)). Feb 1988. 11p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706009/JAW.

Recent data obtained in two experiments performed in the framework of the Bucharest-Dubna collaboration are presented, i.e.: the observation of narrow dibaryonic resonances is neutron-proton interactions in 1mHBC at different momenta of incident neutrons in the range 1-5 GeV/c, and the cumulative production of negative pions in nucleus-nucleus interactions in SKM-200 streamer chamber at 4.5 GeV/c. (authors).

21038 (INIS-BR—1424, pp 26) **($\beta\beta$)/sub oν/ decay and the neutrino mass.** 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21039 (INIS-BR—1424, pp 31) **Superheavy quarkonium decay in a model with two Higgs doublet.** Eboli, O.J.P.; Natale, A.A.; Simao, F.R.A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica; Instituto de Fisica Teorica, Sao Paulo, SP (Brazil); Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21040 (INIS-BR—1424, pp 4) **Yang-Mills theory as the electrodynamics of electric and magnetic currents.** Caticha, A. (Universidade Estadual de Campinas, SP (Brazil)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21041 (INIS-BR—1424, pp 25) **Pp and p-barp elastic scattering analysis at high energies through a Chou-Yang-like formalism with interaction function.** Escobar, B.M.P.; Menon, M.J. (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil); Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21042 (INIS-BR—1424, pp 25) **Hadronic spectra in relativistic models with pion cloud.** Palladino, B.E.; Ferreira, P.L. (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21043 (INIS-BR—1424, pp 25) **Delta-nucleon interaction and the Skyrme model.** Ferreira, E.; Ananias Neto, J. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21044 (INIS-BR—1424, pp 26) **Hyperon semileptonic desintegration in 4 particles.** Ferreira, E.; Queiroz Filho, P.P. de. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21045 (INIS-BR—1424, pp 26) **Comment on the nuclear target effects in J/phi production.** Epele, L.; Fanchiotti, S.; Garcia C, C.A.; Ducati, M.B. de L.G. (La Plata Univ. Nacional (Argentina); Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21046 (INIS-BR—1424, pp 27) **Hadronic production in e/sup +/ e/sup -/ -> hadrons.** Bediaga, I. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21047 (INIS-BR—1424, pp 15) **Hadrons: systems composed by first-order gentileons.** Cattani, M.S.D. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21048 (INIS-BR—1424, pp 20) **Quantization of chiral bosonic particles.** Rivelles, V.O. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21049 (INIS-BR—1424, pp 21) **Chiral bosons and S/sup 1//S/sup 1/ Diff.** Martinez, J.R.R.; Zimerman, A.H.; Teotonio Sobrinho, P. (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil); Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21050 (INIS-BR—1424, pp 23) **Geometric approach to hadron structure: Recent results.** Recami, E.; Zandrin, V.T. (Universidade Estadual de Campinas, SP (Brazil)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21051 (INIS-mf—11381) **Path-integral formulation of supersymmetric string theory.** Verlinde, H.L. (Rijksuniversiteit Utrecht (Netherlands)). 26 Sep 1988. 117p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706079/JAW.

Includes Dutch summary.

The loop corrections to superstring scattering amplitudes are studied. An explicit construction of the partition and correlation functions of all the string fields on an arbitrary ordinary Riemann surface is given in terms of theta-functions. The amplitudes of the space-time supersymmetry current are studied. These are shown to contain unphysical singularities. 94 refs.; 4 figs.

21052 **(INIS-mf—11385) Conformal field theory and its application to strings.** Verlinde, E.P. (Rijksuniversiteit Utrecht (Netherlands)). 26 Sep 1988. 100p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88706083/JAW.

Includes Dutch summary.

Conformal field theories on Riemann surfaces are considered and the result is applied to study the loop amplitudes for bosonic strings. It is shown that there is a close resemblance between the loop amplitudes for phi/sup 3/-theory and the expressions for string multi-loop amplitudes. The similarity between phi/sup 3/-amplitudes in curved backgrounds and the analytic structure of string amplitudes in backgrounds described by conformal field theories is also pointed out. 60 refs.; 5 figs.; 200 schemes.

21053 **(INS—709) Composite weak bosons associated with transmuted gauge symmetry.** Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756886/JAW.

It is shown, from the complementarity viewpoint, that the "flavor" SU(2)/sub L/-invariant four Fermi interactions generating composite weak bosons, W and Z, possess a local "color" SU(2)/sub L//sup loc/ symmetry, which is confined. Through the transmutation of the "color" SU(2)/sub L//sup loc/ symmetry, the SU(2)/sub L//sup loc/-triplet gauge particles are converted into the SU(2)/sub L/-triplet composite weak bosons.

21054 **(INS—712) Excited weak bosons as massive gauge particles of transmuted SU(2)/sub L//sup loc/ symmetry.** Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756889/JAW.

In a model with weak bosons based on the SU(2)/sub L//sup loc/ x U(1)/sub Y//sup loc/ symmetry, excited weak gauge bosons, W* and Z*, are introduced as composites generated by four Fermi interactions. From the complementarity viewpoint that requires a new "color" gauge SU(2)/sub L//sup loc/ symmetry in addition to the "flavor" SU(2)/sub L//sup loc/ x U(1)/sub Y//sup loc/ symmetry, it is argued that the SU(2)/sub L//sup loc/ x U(1)/sub Y//sup loc/ model with W* and Z* is equivalent to an SU(2)/sub L//sup loc/ x U(1)/sub Y//sup loc/ x SU(2)/sub L//sup loc/ model with "color" gauge particles. Furthermore, W* and Z* are shown to be identical to the massive gauge bosons of SU(2)/sub L//sup loc/.

21055 **(ITFA—87-15) Topological charge and fermions in the two-dimensional lattice U(1) model. 1. Staggered fermions.** Smit, J.; Vink, J.C. (Amsterdam Univ. (Netherlands). Inst. voor Theoretische Fysica). Sep 1987. 34p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706091/JAW.

Various definitions of topological charge within the compact QED/sub 2/ model have been investigated. In particular for staggered fermions, the charge and its renormalization factor have been studied. 14 refs.; 7 figs.; 58 schemes.

21056 **(JINR-E—11-88-494) Numerical solution of integral equations, describing mass spectrum of vector mesons.** Zhidkov, E.P.; Nikonov, E.G.; Sidorov, A.V.; Skachkov, N.B.; Khoromskiy, B.N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 22 Sep 1988. 7p. (CONF-880974—3). NTIS (US Sales Only), PC A02 - OSTI. Order Number DE89006590/JAW.

From BEM-10: 10th boundary element meeting; Southampton, UK (6 Sep 1988).

The description of the numerical algorithm for solving quazipotential integral equation in impulse space is presented. The results of numerical computations of the vector meson mass spectrum and the lepton decay width are given in comparison with the experimental data. 6 refs., 4 tabs.

21057 **(LAL—8843) Multihadron Production and a few other Topics.** Haissinski, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France)). Sep 1988. 27p. (CONF-8806260—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757026/JAW.

From 19. international symposium on multiparticle dynamics - new data and theoretical trends; Arles, France (13 Jun 1988).

What follows is the written version of the concluding talk of the XIX/sup th/ Symposium on Multiparticle Dynamics. It draws most of its material from the contributions to this Conference. A few questions related to the electroweak interaction are touched upon, but the emphasis is put on key issues of multihadron production. Some aspects of nucleus-nucleus collisions are also discussed, not only in this context, but also as a means of producing a quark-gluon plasma.

21058 **(NIKHEF-H—88-10) Non-perturbative effects in the exact S-matrices of the O(N) Gross-Neveu and supersymmetric σ models.** Gracey, J.A. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Sep 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706108/JAW.

The factorization of non-perturbative effects in the S-matrices of the O(N) Gross-Neveu and O(N) supersymmetric σ models are examined. It is found that in both cases, the S-matrices can be written in terms of a function of the non-perturbative mass and a convergent power series in an effective coupling constant, at each order in 1/N. 12 refs.; 34 schemes.

21059 **(NIKHEF-H—88-18) Neutrino helicity flips via electroweak interactions and SN1987a.** Gaemers, K.J.F.; Gandhi, R.; Lattimer, J.M.; NIKHEF-H - State Univ. of New York Collaboration. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands); State Univ. of New York, Stony Brook (USA). Dept. of Earth and Space Sciences). (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Oct 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706112/JAW.

Electroweak mechanisms via which neutrinos may flip helicity and become sterile are examined in detail. Exact and approximate expressions for a variety of flip processes relevant in astrophysics and cosmology, mediated by W,Z, and γ exchange, including their interference, are derived. It is shown that within the context of the Standard Model with massive neutrinos, for $\nu e \to \nu e$ scattering, σ/sub Z//sup flip//σ/sub γ//sup flip/ $\sim$ 6 X 10/sup 3/, independent of particle masses and energies to a good approximation. It is also shown that using some general considerations and the fact that the observed anti ν/sup e/ burst from SN1987a lasted several seconds, these weak interaction flip cross-sections can be used to derive an upper limit on μ and tau neutrino masses of $\sim$ 40 keV. Finally, some other consequences for astrophysics in general and supernovae in particular are briefly discussed. 29 refs.; 47 schemes.

21060 **(RAL—88-102) Baryon production in e/sup +/e/sup -/ annihilation.** Saxon, D.H. (Rutherford Appleton Lab., Chilton (UK)). Nov 1988. 28p. (CONF-8810315—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705937/JAW.

From Workshop on diquarks; Turin, Italy (24 Oct 1988).

The phenomenology of baryon production in high energy e/sup +/e/sup -/annihilation is described. Much can be understood in terms of mass effects. Comparisons with the rates for different flavours and spins, with momentum and transverse momentum spectra and with particle correlations are used to confront models. Diquark models give good descriptions, except for the on/off Y(1s) rates. Areas for experimental and theoretical development are indicated.

21061 (SLAC—316, pp 1-4) **From the hadronic photon at $Q^2=O$ to hard scattering at space-like Q^2.** Sloan, T. (Univ. of Lancaster (England)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Real photons ($Q^2=O$) show much larger cross sections for the production of hadrons than would be expected if they interacted only electromagnetically. In contrast the scaling behavior in deep inelastic scattering shows that the space like virtual photons scatter from point like nucleon constituents (quarks) without any form factor effects. Thus space-like virtual photons behave as pure electromagnetic probes whereas real photons behave more like hadrons. In real photoproduction ($Q^2=O$) a large cross section for the production of rho^0 mesons is observed which is $\sim$ 9 times the cross section for omega meson production. These observations led to the formation of the vector meson dominance model (VMD) for the interactions of real photons. In this model the cross section for the photoproduction of vector mesons V is written as; (/sub dt// sup d sigma/) $\gamma p \rightarrow Vp$ = f/sub V/^{2} (/sub dt//sup d sigma/) Vp $\rightarrow$ Vp where f/sub V/ represents the coupling constant between the photon and meson and (/sub dt//sup d sigma/) Vp $\rightarrow$ Vp is the elastic scattering cross section for the vector meson V. The ratio of the coupling constants is expected to be f/sub rho/^{2}:f/sub omega/^{2}:/sub Phi/:f^2/sub J/Psi/:f/sub nu/^{2} = 9:1:2:8:2 from SU(3) symmetry (quark charges). Clearly there is a substantial difference between the behavior of real photons and that of virtual photons at higher Q^2. In this paper, I shall attempt to trace the evolution of the hadron-like behavior of the photon at $Q^2=O$ to its electromagnetic behavior at larger space like Q^2.

21062 (SLAC—316, pp 18-27) **Space-time analysis of muon-produced hadronic showers.** Morfin, J.G. (Fermi National Lab., Batavia, IL (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Hadron showers, produced by high energy muons interacting on various targets, have been analyzed for evidence of a space-time structure of parton fragmentation by the European Muon Collaboration Target-dependent multiplicity ratios and Bose-Einstein interference phenomena both yield information on this subject.

21063 (SLAC—316, pp 28-36) **Nuclear response at medium energy.** Donnelly, T.W. (Massachusetts Institute of Technology, Cambridge (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The use of internal targets to investigate the nuclear response at medium energies is discussed with emphasis being placed on what can be learned by employing targets to study electromagnetic spin physics. The importance of having longitudinally polarized electrons is stressed. Both single-arm and coincidence reactions are discussed and contrasted with similar studies involving final-state polarimetry using external beams and targets. Conclusions are drawn concerning practical implications for polarized internal target experiments.

21064 (SLAC—316, pp 82-91) **Semi-Inclusive inelastic electron scattering from nuclei.** Berger, E.L. (Argonne National Lab., IL (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

A survey presented of the physics of the electroproduction of hadrons from nuclear targets, eA $\rightarrow$ e'hX. Variables and structure functions are specified. The parton model description of electroproduction is summarized; fragmentation functions are defined and their properties are listed. Specific measurements are suggested. Predictions of the pion exchange model are presented for the nuclear dependence of eA $\rightarrow$ e'hX, including a discussion of the special subprocesses $e\pi \rightarrow e'\pi$ in which scattering occurs from the pion constituents of nuclei.

21065 (SLAC—316, pp 127-130) **Kaon electroproduction from the proton and deuteron.** Cotanch, S.R.; Hsiao, S.S. (North Carolina State Univ., Raleigh (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Calculations for the electroproduction reactions p(e,e'K)Y ($Y=\Lambda,\Sigma$) and d(e,e'K)YN are reported to motivate future experiments using different facilities at SLAC. Study of the elementary production processes p(e,e'K)Λ and p(e,e'K)Σ will provide important information about KNY coupling constants, the kaon form factor, and possible differences between Quantum Hadrodynamic and Chromodynamic formulations. Inclusive measurements for d(e,e'K)YN will permit unique investigations of YN interactions as well as a search for strange dibaryons which are predicted to occur at energies near the Sigma N threshold.

21066 (SLAC—316, pp 154-158) **Can pion electroproduction plumb the pion sea?.** Hicks, R.S. (Univ. of Massachusetts, Amherst (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

An outline is given of the proposal that the nuclear pion field can be determined by coincidence electropion production. Experimental requirements for the measurements of (e,e'π) cross sections are discussed, with particular regard to the properties of the PEP storage ring.

21067 (SLAC—316, pp 166-168) **Influence of six-quark bags on electron scattering.** Miller, G.A. (Univ. of Washington, Seattle (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

In the past few years, many worker have tried to use quarks and their interactions to compute nuclear properties. One way to include quarks is to postulate the existence of nuclear six-quark bags, and then predict the influence of such objects on various nuclear reactions. Information about how QCD determines nuclear properties may be obtained if a given reaction turns out to be very sensitive to the presence (or lack) of such objects. Some electronuclear reactions that might yield information about six-quark bags are discussed.

21068 (SLAC—316, pp 204-209) **Spin degrees of freedom in electron nucleon scattering in the resonance region.** Burkert, V.D. (CEBAF, Newport News, VA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Some aspects of using polarized electrons and/or polarized targets in electron/nucleon scattering experiments are discussed. Polarization measurements can be used to extend the knowledge of nucleon form-factor measurements to higher Q^2 and are indispensable for a model-independent extraction of the helicity amplitudes of exclusive meson production. Measurements of polarization asymmetries may also help in revealing the excitation of weaker resonance.

21069 **Evidence for K symmetry in nucleon-nucleon scattering.** Braaten, E.; Cai, D. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208). *Physical Review Letters;* **62**: No. 11, 1243-1246(13 Mar 1989).

Linear relations between the partial-wave amplitudes for nucleon-nucleon scattering are derived from the assumption that the interactions respect K symmetry, which is a combination of isospin and angular momentum. The linear relations are tested using partial-wave amplitudes from phase-shift analyses and are found to be reasonably well satisfied at intermediate energies.

21070 **Radiative quark and lepton masses induced by a fourth generation.** Ma, E. (Department of Physics, University of California, Riverside, California 92521). *Physical Review Letters;* **62**: No. 11, 1228-1231(13 Mar 1989).

Realistic radiative quark and lepton masses for the first two generations, as well as mixing for all three, can be obtained in the context of the standard SU(2)xU(1) electroweak gauge model. The required additional ingredients are a fourth generation and some extra Higgs-boson doublets together with a singlet, as well as a spontaneously broken Z_4 discrete symmetry.

21071 **Spin of the proton and the chiral bag.** Rho, M.; Brown, G.E.; Park, B. (Department of Physics, State University of New York, Stony Brook, New York 11794). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 3, 1173-1175(Mar 1989).

Measurement of the spin carried by the quarks in the proton can be very important in distinguishing between low-energy models of the hadron. Topological soliton models have rather little or no spin in the quarks, in agreement with present experimental indications.

21072 **Catalyzed symmetry breaking in strongly coupled QED.** Kogut, J.B.; Dagotto, E.; Kocic, A. (Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review Letters;* **62**: No. 9, 1001-1004(27 Feb 1989).

We speculate that quantum electrodynamics near its conjectured ultraviolet-stable fixed point acts as a microscope of unlimited resolving power for short-distance interactions, in close analogy with monopole catalysis of proton decay. We illustrate this phenomenon analytically in the quenched ladder approximation by showing that a perturbatively nonrenormalizable parity-violating interaction becomes renormalizable at the fixed point.

21073 **Unitarity effects in W^+W^- elastic scattering.** Repko, W.W.; Suchyta C.J. III. (Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan 48824). *Physical Review Letters;* **62**: No. 8, 859-862(20 Feb 1989).

Unitarity effects associated with the two-channel system consisting of the states W/sub L/$^+$W/sub L/$^-$ and Z/sub L/^{0}Z/sub L/^{0}/ $\sqrt{2}$ are investigated using the K-matrix technique. In W/sub L/$^+$W/sub L/$^-$ elastic scattering, we find that for a Higgs-boson mass (m/sub H/) of 0.5 TeV the unitarized s-wave amplitude is very similar to the Born amplitude modified by the addition of a Higgs-boson width. When m/sub H/ reaches 1.4 TeV, which is above the unitarity bound obtained from the Born term, the unitarized amplitude saturates at an absolute value of about (2/3 of the unitarity limit. The implications of unitarity on W-pair production at Superconducting Super Collider energies are also discussed.

21074 **General amplitudes for three-gauge-boson production and cross sections and polarization analysis at an e^+e^- collider.** Tofighi-Niaki, A.; Gunion, J.F. (Department of Physics, The University of California, Davis, Davis, California 95616). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 720-727(1 Feb 1989).

We give matrix elements for triple-gauge-boson production, including decays to massless-fermion final states. Production of three gauge bosons at high-energy e^+e^- colliders is computed, with emphasis on cross sections and longitudinal-polarization content as a function of the standard-model Higgs-boson mass.

21075 **Probing the WHZ vertex in E_6 models at colliders.** Rizzo, T.G. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 728-735(1 Feb 1989).

We consider the production of charged Higgs scalar bosons at e^+e^- and hadron colliders as a probe of the WHZ/sub i/ vertex which can be nonzero at the tree level in E_6 models. Substantial cross sections at both kinds of colliders are possible but backgrounds are very substantial. These backgrounds can, in principle, be dealt with. e^+e^- annihilation with a light Z_2 may offer the best hope of probing this new interaction.

21076 **Deuteron as a toroidal Skyrmion: Electromagnetic form factors.** Braaten, E.; Carson, L. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 838-843(1 Feb 1989).

The minimal-energy solution in the baryon-number-two sector of the Skyrme model is a toroidally shaped soliton, and its ground state can be identified with the deuteron. A stringent test of this identification is provided by the electromagnetic form factors, since they probe the internal structure of the soliton. These form factors are calculated in the semiclassical approximation and are found to be in qualitative, although not quantitative, agreement with the form factors of the deuteron.

21077 **Semileptonic B and D decays in the quark model.** Isgur, N.; Scora, D.; Grinstein, B.; Wise, M.B. (Department of Physics, University of Toronto, Toronto, Canada M5S 1A7). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 799-818(1 Feb 1989).

We predict the matrix elements and resulting electron spectra for semileptonic meson decays using the quark potential model. Particular attention is paid to the high-energy electron end-point region in B decay since it is crucial to a determination of the b→u weak mixing angle. It is argued that in this region the usual inclusive ("quark decay") calculations are unjustified and must be replaced by explicit sums over decays of the original meson into low-mass exclusive hadronic final states.

21078 **Higgs-boson production from heavy-quark fusion.** Dicus, D.A.; Willenbrock, S. (Center for Particle Theory, University of Texas, Austin, Texas 78712). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 751-757(1 Feb 1989).

We study the production of Higgs bosons from heavy-quark fusion at future hadron colliders. We use a heavy-quark distribution function to combine the processes QQ-bar→H and gQ→HQ with the process gg→QQ-barH to obtain a cross section in which potentially large logarithms, of order ln(m/sub H//m/sub Q/), are summed to all orders in the strong coupling. We show that Higgs bosons which have an enhanced coupling to bottom quarks may be predominantly produced via bottom-quark fusion. We concentrate on the supersymmetric two-Higgs-doublet model, in which this enhancement occurs naturally.

21079 **Approximate multijet cross sections in QCD.** Mangano, M.; Parke, S. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 758-762(1 Feb 1989).

A method is given to approximate the matrix elements squared for all parton processes involving a quark-antiquark pair plus an arbitrary number of gluons. Detailed comparisons are made between the results of this method and the exact results which are known for the quark-antiquark-plus-four-gluon processes in four-jet production at hadron colliders. Together with Maxwell's approximate result for six-gluon processes an excellent agreement is found for the total cross section and shape of four-jet production at hadron colliders

21080 **Multiparticle production in p-p, p-Ar, and p-Xe collisions at 200 GeV by the multistring model VENu-smcapsS.** Werner, K. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 780-791(1 Feb 1989).

We give a detailed description of the multistring model VENu-smcapsS for nucleon-nucleus collisions at ultrarelativistic energies. According to the model, color strings are formed as a consequence of color exchange between quarks of colliding nucleons. Sequences of nucleon-nucleon collisions are determined from geometrical considerations. We calculate, among other things, multiplicity distribution for various rapidity intervals for p-p, p-Ar, and p-Xe at 200 GeV, to compare with negative-binomial fits to data.

21081 **CP asymmetries in charmless baryonic decays of charged B mesons.** Eilam, G.; Gronau, M.; Rosner, J.L. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 3, 819-824(1 Feb 1989).

The CP asymmetry in charmless inclusive hadronic decays of charged B mesons is calculated in the three-generation Kobayashi-Maskawa model. Asymmetries are found favoring the decays of B^+ over B^- which may be as large as 3% and 5% for strangeness zero and one final states, respectively. It is suggested that asymmetries at this level or larger may be observable in the decay modes B/sup +- /→pp-barπ/sup +- / and B/sup +- /→pp-barK/sup +- /.

21082 **Are there really any experimental limits on a light Higgs boson?.** Raby, S.; West, G.B.; Hoffman, C.M. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 3, 828-833(1 Feb 1989).

The experimental evidence regarding a light Higgs boson is reviewed. It is shown that a light Higgs boson with almost any mass between 14 MeV/c^2 and 1 GeV/c^2 is still allowed by existing data. The only limit in this range comes from B-decay data which, for sufficiently large values of the top-quark mass, excludes a Higgs boson with a mass between 2m/sub μ/ and ~700 MeV/c^2. Discussions of light-Higgs-boson emission in the decays of K, π, μ, tau, eta', and Y are also given.

21083 **QCD-based effective Lagrangian including quark mass effects: Calculation of f/sub K/.** Munczek, H.J.; McKay, D.W. (Department of Physics and Astronomy, The University of Kansas, Lawrence, Kansas 66045). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 3, 888-895(1 Feb 1989).

Quark mass effects are included in the construction of an effective Lagrangian with bilocal pion and kaon fields. We discuss the appropriate Schwinger-Dyson equations and the choice of pseudo- scalar particle wave functions in the presence of explicit chiral-symmetry breaking. Identifying the pseudoscalar-mass terms in the effective Lagrangian, we reproduce the standard current-algebra mass formulas for charged pions and kaons. Approximate solutions to the u-, d-, and s-quark Schwinger-Dyson equations are constructed. The low-q^2 region is realistically modeled and the intermediate- and large-q^2 regions are represented by a superposition of the well-known "spontaneous" and "explicit" breaking asymptotic QCD solutions. We couple the W-boson gauge invariantly to the dynamical quarks and derive formulas for the pion and kaon decay constants f/sub π/ and f/sub K/ in the one-quark-loop approximation. With f/sub π/ = 93 MeV as input, we calculate the value f/sub K//f/sub π/ = 1.13, compared to 1.16 experimentally, for a representative value Λ/sub QCD/ = 200 MeV. In addition, we comment on the calculation of the pion electromagnetic form factor.

21084 **Techniomega production in pp colliders.** Rosenfeld, R. (Enrico Fermi Institute and Department of Physics, University of Chicago, Chicago, Illinois 60637). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 3, 971-973(1 Feb 1989).

We compute the cross section for techniomega production in pp colliders at $\sqrt{s}$ = 17 and 40 TeV via a gauge-boson-fusion process analogous to the $\pi\pi\to\pi\omega$ process in QCD. Prospects for the detection of this resonance are discussed.

21085 **Nonsingular potential model for heavy quarkonia.** Gupta, S.N.; Repko, W.W.; SuchytaIII, C.J. (Department of Physics, Wayne State University, Detroit, Michigan 48202). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 3, 974-977(1 Feb 1989).

A nonsingular potential model for heavy quarkonia is described which does not require recourse to an illegitimate perturbative treatment for the investigation of quarkonium spectra. Our overall results for the energy levels, the leptonic widths, and the E1 transition widths are in very good agreement with the experimental data for bb-bar and they are reasonably good for cc-bar. We also find that the confining part of the quarkonium potential is scalar-vector exchange rather than the currently favored scalar exchange.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 21075, 21078, 21084, 21128, 21129, 21136, 21137, 21407, 21408, 21410

21086 (INIS-BR—1424, pp 16) **CP violation of cosmological origin.** Fleming, H.; Truppel, W.L. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21087 (INIS-BR—1424, pp 19) **Information on the gauge principle of a N=1/2, D=2 supersymmetric model.** Dias, S.A.; Valle, J.L.M.; Doria, R.M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ; Universidade Catolica de Petropolis (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21088 (INIS-BR—1424, pp 21) **Supersymmetric Schild's string.** Gamboa, J.; Altaba, M.R. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica; Centre Nationale de la Recherche Scientifique, Geneve (Switzerland)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21089 (INIS-BR—1424, pp 30) **Supersymmetry and generalization of the V(z) = β tanh (z) - γ/sub +-/ sech (z) (used in polymers too).** Drigo Filho, E. (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21090 **(RRK—88-32) Bosonic string at D < 26 and Higgs mechanism.** Fujikawa, Kazuo; Nakazawa, Naohito; Suzuki, Hiroshi. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Oct 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756929/JAW.

On the basis of a BRS invariant formulation of a free bosonic string at D < 26, we analyse the structures of BRS and ghost number operators and the string vacua. The ghost number and the mass spectrum are naturally related to each other in this scheme. By using a string field theoretical technique, it is also shown that the Weyl freedom gives rise to an unphysical Higgs scalar, which is absorbed by the vector particle in the first excited level, and thus realizing the Higgs mechanism.

21091 **Unitarity constraints on heavy Higgs bosons.** Dawson, S.; Willenbrock, S. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **62**: No. 11, 1232-1235(13 Mar 1989).

We calculate the complete set of O(G/sub F/M/sub H/^{2}) corrections to the elastic scattering of longitudinally polarized W bosons in the limit s,M/sub H/^{2}>>M/sub W/^{2}, for any value of s/M/sub H/^{2}. For any Higgs-boson mass such that M/sub H/ >>M/sub W/, there exists a critical energy above which partial-wave unitarity is violated and the one-loop correction to the J = 0 partial wave is large, indicating the breakdown of perturbation theory.

21092 **Can the observed baryon asymmetry be produced at the electroweak phase transition?.** McLerran, L. (Fermi National Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review Letters;* **62**: No. 10, 1075-1078(6 Mar 1989).

The possibility is investigated that the baryon asymmetry of the Universe might have been created at the electroweak phase transition. It is shown that there exists a process which may in certain models with multiple Higgs doublets generate a numerically acceptable asymmetry. This process involves sphalerons and requires strong CP violation at temperatures larger than 1 TeV.

21093 **Electromagnetic properties of generalized Majorana particles.** Boudjema, F.; Hamzaoui, C.; Rahal, V.; Ren, H.C. (School of Mathematic and Physical Sciences, University of Sussex, Brighton BN1 9QH, England). *Physical Review Letters;* **62**: No. 8, 852-854(20 Feb 1989).

We prove a theorem stating that a massive Majorana particle (a CPT-self-conjugate particle) with arbitrary spin J can possess only an anapole moment and multipoles of that. We also show that massless Majorana particles, except those of spin (1/2, do not have any single-photon electromagnetic form factor.

21094 **D = 10 superspace geometry and heterotic superstring theory (I).** Bellucci, S. (INFN-Laboratori Nazionali di Frascati, Casella Postale 13,00044 Frascati (Roma) (IT)). *Modern Physics Letters B;* **3**: No. 18, 1775-1784(Dec 1988).

Using a Weyl transformation in superspace, the authors provide a noncanonical formulation of standard D = 10, N = 1, supergravity, including the gauge matter sector. This formulation turns out to be ideally suited for carrying out the renormalization of the Green-Schwarz σ-model describing the D = 10 heterotic string propagating in a curved background space. By reducing the super-space results to the component level, the authors derive the supersymmetry transformation laws for the component fields of the theory.

6454 Field Theory

REFER ALSO TO CITATION(S) 21072, 21076, 21079, 21083, 21084, 21085

21095 **(BiBoS—282/87) Locally independent boson systems.** Fichtner, K.H.; Schreiter, U. (Friedrich-Schiller Universitaet, Jena (German Democratic Republic). Sektion Mathematik). (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)). 1987. 26p. Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS).

Glauber and Titulaer deal with coherent states of photon systems. They discuss a characterization of these states by the property of local independence. In our paper we characterize the class of all locally normal states of boson systems being locally independent in this sense.

21096 **(BiBoS—300/88) Quantization of bosonic closed strings and the Liouville model.** Paycha, S. (Bochum Univ. (Germany, F.R.)). (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS); Bochum Univ. (Germany, F.R.)). 1988. 33p. Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS).

The author shows that by means of a reasonable interpretation of the Lebesgue measure describing the partition function the quantization of closed bosonic strings described by compact surfaces of genus p>1 can be related to that of the Liouville model. (HSI).

21097 **(DOE/ER/40265—16) Extracting physics from the lattice higgs model.** Neuberger, H. (Rutgers--the State Univ., Piscataway, NJ (USA). Dept. of Physics and Astronomy). May 1988. Contract FG05-86ER40265. 6p. (CONF-8805175—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007390/JAW.

From Lattice Higgs workshop; Tallahassee, FL, USA (16 May 1988).

The relevance and usefulness of lattice $\{phi\}^4$ for particle physics is discussed from older and newer points of view. The talk will start with a review of the main ideas and suggestions in my work in the past with Dashen and will proceed to present newer developments both on the conceptual and the practical level. 12 refs.

21098 **(DOE/ER/40265—18) Lattice BRS.** Neuberger, H. (Rutgers--the State Univ., Piscataway, NJ (USA). Dept. of Physics and Astronomy). 1988. Contract FG05-86ER40265. 5p. (CONF-8806105—4). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007389/JAW.

From 17. international colloquium on group theoretical methods in physics; St. Adele, Canada (27 Jun 1988).

A definition of lattice BRS invariance is given. The requirement of lattice BRS invariance successfully replaces that of local gauge invariance as a principle for selecting allowed actions. This replacement also works to any finite order in perturbation theory, but, on the nonperturbative level one encounters an obstacle reflecting the existence of an even number of solutions to the gauge fixing problem. The problem of latticizing the classical action for open bosonic strings discovered by Witten is discussed and a possible direction for dealing with it is pointed out. 3 refs.

21099 **(DOE/ER/40371—2) [Intermediate/high energy nuclear physics].** (Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). [1989]. Contract FG02-87ER40371. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008365/JAW.

We have continued to develop a theoretical framework for the quark and gluon structure of nuclei. Our approach features a successful phenomenological model, the quark cluster model (QCM), and an ambitious program in the non-perturbative solution of quantum field theories. The effort in quantum field theory provides theoretical results to test or replace assumed ingredients of the QCM. By the explicit example of a scalar field theory in 2D we have solved the long-standing problem of how to treat the dynamics of the vacuum in light-front quantization. We now propose to solve the same problem for simple Fermion field theories in 2D such as the Gross-Neveu model. We propose in subsequent years to address QCD in low dimensionality with the purpose of extracting non-perturbative predictions for quark and gluon amplitudes in few baryon systems. Simultaneously with this new effort we will continue to develop extensions and applications of the QCM. We propose to continue predicting phenomena to be observed in high energy particle-nucleus collisions that reflect the rearrangement of quarks and gluons in nuclei. We have completed our analysis of the SLAC E101 and E133 experiments on Deuterium to elucidate the degree to which a six-quark cluster contribution is admissable in the Bjorken x > 1 data. We have completed our development of a parameterized thermal liquid drop model for light nuclei. In additicn we have completed a set of predictions for the formation of a "nuclear stratosphere" in nuclei created by intermediate energy heavy ion interactions. These results motivate a new investigation of the temperature dependence of the ion-ion potential with particular emphasis on the thermal dependence of the barrier height and radius. We have also shown that a consistent treatment of relativistic effects is important for a theoretical description of the elastic magnetic form factor of ^{17}O. 85 refs.

21100 **(GSI—89-07-Prepr.) On the treatment of initial correlations in quantum field theory of non-equilibrium states.** Henning, P.A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1989. 21p. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The author provides a systematic derivation of Feynman rules for correlated states by means of the method developed by J. Schwinger (1961) and L. V. Keldysh (1965) using a real-time Green function for non-equilibrium states in quantum field theory. He consisders the special case of a single scalar field with self-interaction. Especially the fitting of correlation diagrams into perturbation theory is discussed. The translation of the modified perturbation series into diagram rules is explicitely described for the PHI/sup 4/ theory. (HSI).

21101 **(IC—88/219) Renormalization of QED at low temperature and high density.** Saleem, S. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705976/JAW.

The results of the calculation of charge renormalization constant in QED at low temperature and high value of the chemical potential is presented. It completes the discussion of renormalization of QED in different limits of temperature and chemical potential. As a simple illustration of this procedure the scalar Higgs decay (H->e/sup +/e/sup -/) rate is corrected for this limit showing that the KLN theorem of QED is correct for this region of temperatures and chemical potential also. (author). 12 refs, 2 figs.

21102 **(IC—88/356) Strings on hyperelliptic supersurfaces.** Crnkovic, C.; Sotkov, G.M. (International Centre for Theoretical Physics, Trieste (Italy); International School of Advanced Studies, Trieste (Italy)). (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 33p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705991/JAW.

Starting from a definition of a hyperelliptic superRiemann surface (HESS), we study its supermoduli space and the "superVirasoro" algebra on it. We map that algebra into a Z/sub 4//sup p=2/ parafermionic algebra on CP/sup 1,1/. Using explicitly supersymmetric bosonization of the first-order superconformal systems, we construct explicitly the primary fields of the parafermionic algebra: the branching and the spin operators. We give a simple prescription for the calculation of sdetD-bar/sub λ/ on HESS through correlation functions of these branching operators. As an example, we calculate the g=2 superstring partition function and verify that the cosmological constant is zero up to a total derivative in the even moduli. (author). 27 refs.

21103 **(IC—88/367) Composition dependent forces as superstring effects.** Ivanov, B.V. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705995/JAW.

We show that the exchange of dilaton and compacton scalars which belong to the massless sector of superstring theory leads to the appearance of a composition dependent fifth force. (author). 17 refs.

21104 **(IC—88/386) Note on the geometrical meaning of the gauge coupling constant.** Nikolova, L. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705997/JAW.

A generalization of the notion of a connection form in a principal fibre bundle is proposed in order to clarify the geometrical meaning of the gauge coupling constant in gauge field theories. (author). 2 refs.

21105 **(IC—88/387) Renormalization of topological field theory.** Birmingham, D.; Rakowski, M.; Thompson, G. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705998/JAW.

One loop corrections to topological field theory in three and four dimensions are presented. By regularizing determinants, we compute the effective action and β-function in four dimensional topological Yang-Mills theory and find that the BRST symmetry is preserved. Moreover, the minima of the effective action still correspond to instanton configurations. In three dimensions, an analysis of the Chern-Simons theory shows that the topological nature of the theory is also preserved to this order. In addition, we find that this theory possesses an extra supersymmetry when quantized in the Landau gauge. Using dimensional regularization, we then study the Ward identities of the extended BRST symmetry in the three dimensional topological Yang-Mills-Higgs model. (author). 22 refs.

21106 **(IFIN-FT—323-1987) Periodicity effect in the two centre Dirac equation.** Ixaru, L.G.; Pantea, D. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Dec 1987. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706041/JAW.

On relying on the fact that the electron positron pair production in heavy ion collisions is essentialy governed by the two centre Dirac equation, some mathematical properties of the solution of this equation are here examined to find out the existence of a periodicity effect.(authors).

21107 (INIS-BR—1424, pp 4) **Ultraviolet stability for QED in 3 and 4 dimensions via Block renormalization group methods.** Balaban, T.; O'Carroll, M.; Schor, R.S. (Boston Univ., MA (USA); Minas Gerais Univ., Belo Horizonte (Brazil)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21108 (INIS-BR—1424, pp 5) **Gaussian approximation to the free energy of a soliton in the Schroedinger representation.** Negrini Neto, O.; Silva, A.J. da. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21109 (INIS-BR—1424, pp 5) **Non-abelian theories and stochastic quantization (QE).** Pimentel, B.M.; Suzuki, A.T.; Kolck, U.L. van. (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil); Texas Univ., Austin (USA)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21110 (INIS-BR—1424, pp 6) **Vacuum polarization potential and a minimum for the Colomb law shift.** Lucinda, J. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21111 (INIS-BR—1424, pp 6) **BRST symmetry in the chiral Schwinger model.** Barcelos Neto, J.; Souza, C.F. de. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21112 (INIS-BR—1424, pp 7) **Correct use of the Fujikawa's prescription in the chiral Schwinger model and the Wess-Zumino term.** Barcelos Neto, J.; Souza, C.F. de. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21113 (INIS-BR—1424, pp 14) **Inverse scattering method applied to the non-linear Schroedinger equation.** Wreszinski, W.F.; Marvulle, V. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21114 (INIS-BR—1424, pp 14) **Noether theorem in classical field theory and gravitation.** Fleming, H.; Vicente, G.A. (Sao Paulo Univ., SP (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21115 (INIS-BR—1424, pp 17) **Stochastic quantization of the nonlinear sigma model and background field method.** Abdalla, E.; Carvalho Filho, F.M. de; Viana, R.L. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21116 (INIS-BR—1424, pp 17) **Renormalization transformation study for the lattice U(1) gauge theory in the neighbourhood of the gaussian fixed point.** Neves, A.G.M.; Schor, R.S. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21117 (INIS-BR—1424, pp 17) **Feynman's propagator for the time-dependent three-dimensional charged harmonic oscillator in a time-varying magnetic-field directly by Schroedinger equation.** Bassalo, J.M.F.; Botelho, L.C.L.; Antunes Neto, H.S.; Alencar, P.T.S. (Para Univ., Belem, PA (Brazil)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21118 (INIS-BR—1424, pp 18) **Aspects of the functional quantization of constrained systems in field theory.** Natividade, C.P.; Barcelos Neto, J. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21119 (INIS-BR—1424, pp 19) **Bosonic string spectrum in the Polyakov's formalism.** Takakura, F.I.; Marino, E.C. (Universidade Catolica de Petropolis (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21120 (INIS-BR—1424, pp 19) **Chiral bosonization.** Girotti, H.O.; Gomes, M.; Kurak, V.; Rivelles, V.O.; Silva, A.J. da. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21121 (INIS-BR—1424, pp 21) **Alternative quantization of second class constrained systems.** Masperi, L.; Montfmayor, R. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). 1988. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21122 (INIS-BR—1424, pp 29) **Skyrmion quantum theory in the long wavelength limit of antiferromagnetic spin systems.** Furuya, K.; Marino, E.C. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21123 (INIS-BR—1424, pp 30) **Solitons and polarons in field theories applied to polymers.** Carvalho, C.A. de. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21124 (INIS-BR—1424, pp 30) **Quantum fields out of thermal equillibrium and the inflationary process dynamics.** Eboli, O.J.P. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21125 (INIS-BR—1424, pp 31) **Behaviour of the quantum kink mass with the temperature.** Macedo, A.A.S. de; Marino, E.C. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21126 **(INS—710) Duality in ADE type conformal field theory.** Sogo, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756887/JAW.

By use of the level N representation of simply laced (A, D and E) Kac Moody algebras, we construct their Z algebra and W algebra explicitly, which provide novel extensions of the minimal series. In due course is observed the duality between rank and level. Conformal charges for such models are given along with partition functions, supersymmetric extensions and corresponding Temperley-Lieb algebras.

21127 **(NIKHEF-H—88-15) Local BRST invariance and the dynamical origin of the BRST condition.** Holten, J.W. van. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Sep 1988. 28p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706109/JAW.

The BRST invariance of theories with local space-time symmetries, such as the reparametrization-invariant point-particle or d-dimensional general relativity, and of theories with local internal symmetries, like abelian and non-abelian gauge theories, can be gauged without changing the physical content of the theory, at least at the level of perturbation theory. In such a formulation the BRST condition $Q=0$ can be derived from the dynamics, instead of having to be imposed as an additional constraint needed to distinguish between the physical and unphysical solutions of the theory. This construction then leads to an infinite hierarchy of BRST symmetries, all with the same cohomology. 18 refs.; 105 schemes.

21128 **(NIKHEF-H—88-16) On the quantum theory of the superparticle.** Kowalski-Glikman, J.; Holten, J.W. van. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Sep 1988. 6p. (CONF-8805272—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88706110/JAW.

From International symposium on spacetime symmetries; Maryland, USA (24 May 1988).

The authors present a new off-shell formulation of the Brink-Schwarz superparticle. The algebra of Siegel's transformations is

closed and abelian. A covariant BRST quantization of the theory is discussed. 7 refs.; 11 schemes.

21129 **(NIKHEF-H—88-17) Sl(1chemical bond1;R)-Cohomologies in BRST-Gupta-Bleuler quantization.** Hasiewicz, Z.; Kowalski-Glikman, J.; Lukierski, J.; Holten, J.W. van; NIKHEF - CHEAF - Leuven Univ. - Wroclaw Univ. Collaboration. (Louvain Univ. (Belgium). Inst. for Theoretical Physics; Wroclaw Univ. (Poland). Inst. Fizyki Teoretycznej; CHEAF, Amsterdam (Netherlands); Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H; Wroclaw Univ. (Poland). Inst. Fizyki Teoretycznej; Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Sep 1988. 7p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706111/JAW.

For any theory with holomorphic first-class constraints the authors construct the real sl(1chemical bond1;R)-cohomology operator, the cohomolgy classes of which coincide with physical states defined by complex BRST-operators in Gupta-Bleuler quantization scheme. 6 refs.; 25 schemes.

21130 **(RRK—88-26) Non-Abelian Feigin-Fuchs deformation of (super-)conformal algebras.** Yoshii, Hisahiro. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Sep 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756925/JAW.

Nonlinear realization of a superconformal algebra in two dimensions with an arbitrary central charge is constructed. We discuss the non-Abelian fermionic Feigin-Fuchs deformation of (super-)WZW models and deduce some new class of conformal algebras.

21131 **(RRK—88-27) Superspace formulation of stochastic background field method.** Nakazawa, Naohito. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Sep 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756926/JAW.

We formulate the background field method for a nonlinear σ-model in stochastic quantization based on the superspace formulation. In adition to the general covariance, the BRS invariance of the system is manifestly maintained in our formulation.

21132 **(RRK—88-30) String field equation from renormalization group.** Sakai, Kenji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Oct 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756927/JAW.

We derive an equation of motion for an open bosonic string field which is introduced as a background field in a sigma model. By using the method of Klebanov and Susskind, we obtain the β-function for this background field and investigate its properties.

21133 **(RRK—88-31) Derivation of gauge and gravitational induced Chern-Simons terms in three dimensions.** Ojima, Shuichi. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Oct 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756928/JAW.

We study the theory of fermions coupled to external gauge and gravitational fields. In three dimensions, the existence of massive fermions is known to lead to the induced Chern-Simons term. We derive the induced Chern-Simons term by a path integral method.

21134 **(UNICAMP-IMECC-RT—03/88) Mathematical physics of the generalized monopole without string.** Rodrigues Junior, W.A.; Rosa, M.A.F.; Maia Junior, A.; Recami, E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Matematica, Estatistica e Ciencia da Computacao). 1988. 49p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705605/JAW.

In this paper we present a theory of the generalized magnetic monopole without string, which is distinct from Dirac's original theory and distinct from the topological theory of the monopole. Our theory is first formulated in the Clifford bundle formalism; and in the particular case of electrodynamics we deduce from Maxwell equations the generalized Lorentz force and the equations of motion of charges and monopoles. We discuss the conservation laws and the problem of the Lagrangian formalism. We obtain Dirac quantization condition in two different ways. Finally, we present a principal fiber bundle formulation of our theory using the spliced-bundle concept with gauge group GxG, where G is the gauge group of the theory without monopoles.

21135 **Discrete gauge symmetry in continuum theories.** Krauss, L.M.; Wilczek, F. (Institute for Theoretical Physics, University of California at Santa Barbara, Santa Barbara, California 93106). *Physical Review Letters;* **62**: No. 11, 1221-1223(13 Mar 1989).

We point out that local symmetries can masquerade as discrete global symmetries to an observer equipped with only low-energy probes. The existence of the underlying local gauge invariance can, however, result in observable Aharonov-Bohm-type effects. Black holes can therefore carry discrete gauge charges: a form of nonclassical "hair." Neither black-hole evaporation, wormholes, nor anything else can violate discrete gauge symmetries. In supersymmetric unified theories such discrete symmetries can forbid proton-decay amplitudes that might otherwise be catastrophic.

21136 **Computer simulation of chiral-symmetry breaking in (2+1)-dimensional QED with N flavors.** Dagotto, E.; Kogut, J.B.; Kocic, A. (Department of Physics, University of Illinois at Urbana-Champaign, Loomis Laboratory, 1110 W. Green St., Urbana, Illinois 61801). *Physical Review Letters;* **62**: No. 10, 1083-1086(6 Mar 1989).

Noncompact quantum electrodynamics in three Euclidean dimensions with N species of four-component Dirac fermions is simulated by lattice-gauge-theory techniques. On an 8^3 lattice we find chiral-symmetry breaking in the continuum limit for N≦N/sub c/ but no symmetry breaking for N≧N/sub c/, with N/sub c/ = 3.5 +- 0.5. A physical picture of our results is presented.

21137 **Higgs bosons in a nonminimal supersymmetric model.** Ellis, J.; Gunion, J.F.; Haber, H.E.; Roszkowski, L.; Zwirner, F. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305 and Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 844-869(1 Feb 1989).

The minimal supersymmetric standard model contains two Higgs doublets which must mix via a mass parameter whose magnitude remains to be explained. We explore an extension of the minimal model to include a singlet Higgs field whose vacuum expectation value determines the mixing. We study the spectrum and couplings of Higgs bosons in this extended model and compare them with those in the minimal model. We examine a number of limiting cases analytically and also make numerical studies of the extended model both with and without constraints from the renormalization-group analysis of a parent superstring-inspired grand-unified-theory model. We establish the conditions for there to be a charged Higgs boson lighter than the W/sup +- / and the circumstances under which there is no light neutral Higgs boson. With a particularly simple set of boundary conditions at the unification scale, the renormalization-group equations imply that one or more Higgs bosons are light enough to be found at the CERN LEP or SLAC Linear Collider and that many supersymmetric particles should be accessible to these accelerators and the Fermilab Tevatron; relatively few would require the Superconducting Super Collider, Large Hadron Collider, or a TeV-scale e^+e^- collider for discovery. Finally, we analyze the possible production mechanisms and phenomenological signatures of the different Higgs bosons at these machines.

21138 **Lattice heavy-meson decay constants and fermion universality.** Woloshyn, R.M.; Draper, T.; Liu, K.F.; Wilcox, W. (TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia, Canada V6T 2A3). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 978-981(1 Feb 1989).

The mass dependence of decay constants for vector and pseudoscalar mesons is calculated using both Wilson and staggered-fermion formulations in quenched lattice QCD. For low meson masses, the agreement of the two methods is good and the determination of the vector decay constant agrees with experiment. For pseudoscalar heavy-quark—light-quark systems, we find reasonable agreement between the two fermion formulations as long as Maapprox. <1, where M is the meson mass.

21139 **Quantum stabilization of the Skyrme soliton.** Jain, P.; Schechter, J.; Sorkin, R. (Physics Department, Syracuse University, Syracuse, New York 13244-1130). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 998-1001(1 Feb 1989).

We point out that the putative Skyrme soliton in a simple chiral model of pions (without the Skyrme term) can be stabilized against collapse by quantum fluctuations. This leads to a reasonable "zeroth order" description of the nucleon in terms of the single (pion decay) constant F/sub π/.

21140 **Self-consistent nonperturbative effect of string fragmentation on superstring mass spectra.** Balazs, L.A.P. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). *Physical Review [Section] D: Particles and Fields;* **39**: No. 3, 1002-1005(1 Feb 1989).

Using a simple model for soft self-consistent nonperturbative string fragmentation-recombination loops, we find that, in an open-string theory, ground-state particles necessary for the standard model either become tachyons or acquire large (Planck-scale) masses, making them unacceptable for sub-Planck-scale phenomenology. No comparable difficulties are evident for closed-string theories.

65 PHYSICS II

REFER ALSO TO CITATION(S) 21416

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 20393

21141 (ANL-PHY—88-2, pp 1-20) **Perspectives in nuclear structure.** Mottelson, B.R. 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

It's a wonderful time to be alive, for a nuclear spectroscopist. Beautiful results are being reported almost every day and marvelous new instruments are being developed. It is not only the discovery of experimental showpieces, but also the authors understanding of nuclei is being significantly deepened as they begin insight into the interplay of shell structure and collective rotation as well as the damping effects of thermal excitation on these degrees of freedom.

21142 (ANL-PHY—88-2, pp 288-291) **Variation with angular momentum of inertia of yrast collective bands in even-even nuclei.** Sharon, Y.Y.; Naumann, R.A. (Princeton Univ., NJ (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The low-lying rotational and quasi-rotational ground-state yrast sequences of the strongly and moderately deformed even-even nuclei (below the back-bending irregularities) often exhibit a smooth and continuous increase of level energy E(J) with increasing angular momentum J. This observation has prompted in the past the development of several nuclear models. This paper presents a generalization of the variable moment of inertia (VMI) model that often accounts better for the experimental energies of the high-j yrast states. A simple rotational-vibrational system is described which can be treated semiclassically.

21143 **(DOE/ER/40410—1) Nuclear structure investigations on spherical nuclei: Progress report.** Heisenberg, J.; Calarco, J.; Dawson, J.; Hersman, F.W. (New Hampshire Univ., Durham (USA). Dept. of Physics). Sep 1988. Contract FG02-88ER40410. 76p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008584/JAW.

This report discusses progress in the following areas of nuclear structure research: structure of low lying states; giant resonance studies; deep inelastic scattering; and nuclear theory. (LSP)

21144 (HMI-B—459, pp 1-13) **Evolution of direct mechanisms with incident energy from the Coulomb-barrier to relativistic energies.** Oertzen, W. von. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.); Freie Univ. Berlin (Germany, F.R.)). Oct 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757129/JAW. (CONF-880795—).

From Tokyo symposium on heavy-ion and nuclear astrophysical problems; Tokyo, Japan (19 Jul 1988).

The author reviews the experimental results on heavy ion reactions whereby the reaction mechanisms at different energies are considered. (HSI).

21145 **(IKDA—88/15) Status and perspectives of the M1 scissors mode in nuclei.** Richter, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). Jul 1988. 39p. (CONF-880639—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756950/JAW.

From International conference on contemporary topics in nuclear structure physics; Cocoyoc, Mexico (9 Jun 1988).

The present status of the M1 scissors mode which is now known in deformed nuclei ranging from /sup 46/Ti to /sup 238/U is summarized. Particular emphasis is placed on a discussion of the structure, the excitation energy, the transition strength, the form factor and the spin to orbit ratio in the strength of the mode. Finally it is demonstrated how strongly this mode contributes to the magnetic dipole polarizability of nuclei.

21146 **(IKDA—88/16) Elementary isovector spin and orbital magnetic dipole modes revisited in the shell model.** Richter, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). Aug 1988. 42p. (CONF-8805256—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756951/JAW.

From 2. International spring Seminar on Nuclear Physics; Capri, Italy (16 May 1988).

A review is given on the status of mainly spin magnetic dipole modes in some sd- and fp-shell nuclei studied with inelastic electron and proton scattering, and by β/sup +/-decay. Particular emphasis is also placed on a fairly new, mainly orbital magnetic dipole mode investigated by high-resolution (e,e') and (p,p') scattering experiments on a series of fp-shell nuclei. Both modes are discussed in terms of the shell model with various effective interactions.

21147 (KURRI-TR—303, pp 12-14) **Ion traps and their applications.** Fujioka, M. (Tohoku Univ., Sendai (Japan). Cyclotron and Radioisotope Center). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

21148 **(LBL—25295) Nuclear Science Division annual report, October 1, 1986--September 30, 1987.** Mahoney, J. (ed.). (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 202p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008841/JAW.

This report summarizes the activities of the Nuclear Science Division during the period October 1, 1986 to September 30, 1987. A highlight of the experimental program during this time was the completion of the first round of heavy-ion running at CERN with ultrarelativistic oxygen and sulfur beams. Very rapid progress is being made in the analysis of these important experiments and preliminary results are presented in this report. During this period, the

Bevalac also continued to produce significant new physics results, while demand for beam time remained high. An important new community of users has arrived on the scene, eager to exploit the unique low-energy heavy-beam capabilities of the Bevalac. Another major highlight of the program has been the performance of the Dilepton Spectrometer which has entered into production running. Dileptons have been observed in the p + Be and Ca + Ca reactions at several bombarding energies. New data on pion production with heavy beams measured in the streamer chamber to shed light on the question of nuclear compressibility, while posing some new questions concerning the role of Coulomb forces on the observed pion spectra. In another quite different area, the pioneering research with radioactive beams is continuing and is proving to be one of the fastest growing programs at the Bevalac. Exotic secondary beams (e.g., 8He, 11Li, and 14Be) have been produced for fundamental nuclear physics studies. In order to further enhance the scientific research program and ensure the continued vitality of the facility, the Laboratory has proposed an upgrade of the existing Bevalac. Specifically, the Upgrade would replace the Bevatron with a modern, strong-focusing synchrotron to provide higher intensity and higher quality beams to continue the forefront research program. Other papers on nuclear physics research are included in this report.

21149 (SLAC—316, pp 212-214) **Scattering of polarized electrons from oriented rotational nuclei.** Moya de Guerra, E.; Sarriguren, P. (I.E.M.. Madrid (Spain)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The interest of using polarized beam and target to extract information on current distributions in rotational nuclei is pointed out. The differential cross section for elastic and inelastic scattering of longitudinally polarized electrons from oriented nuclei is analyzed in detail focusing on the case of K = 1/2 ground state bands.

21150 **(UCID—18987-89) Report to the DOE Nuclear Data Committee, 1989.** Struble, G.L.; White, R.M.; Resler, D.A. (Lawrence Livermore National Lab., CA (USA)). Feb 1989. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008650/JAW.

This report contains short papers on nuclear data measurements, calculations, and evaluations. (LSP)

6511 Experimental Techniques

21151 **(LA-UR—89-619) Opportunities for research program development at LANSCE.** Bowman, C.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 27p. (CONF-8810182—19). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008015/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

The availability of intense neutron beams from facilities associated with the Proton Storage Ring and LANSCE has stimulated the development of neutron research well beyond the mainstream of neutron scattering. A description of this extended program is given along with prospects for further growth. 23 refs., 11 figs., 4 tabs.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

21152 **(INIS-mf—11919) Measurement of the differential cross section of the three-nucleon reaction n+d -> n+n+p in the star configuration at E/sub n/ = 10.3 MeV.** Stephan, M. (Bochum Univ. (Germany, F.R.). Fakultaet fuer Physik und Astronomie). 18 Dec 1987. 102p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757143/JAW.

In the 'star configuration' the three nucleons move in the c.m. system with angles of each Δphi/sub 12/ = 120/sup 0/ in the plane the normal of which lies in direction of the c.m. velocity. In the kinematically complete experiment both in the target produced breakupneutrons were detected. For this liquid NE213 scintillation detectors were arranged under the angles θ/sub 1/ = θ/sub 2/ = 48.9/sup 0/ and Δphi/sub 12/ = 120/sup 0/. For the background reduction additionally the breakup proton in the target was detected. The determination of the absolute neutron flux resulted since a detector detected simultaneously with the breakup measurement elastic neutron-proton scatterings. The measured values were projected on the 'mean kinematical curve'. In the region of the star configuration the measured breakup cross section amounts to (1.24+-0.1) mb/sr/sup 2/ MeV. The measurement result was compared to two theoretical calculations. The calculations with a s-wave Yamaguchi potential with charge-dependent form factors yield a cross section by 20% too low. However the results of latest calculations with a realistic potential ('new Bonn-OBEPQ-potential') agree in the framework of the measurement uncertainty with the measured values. (orig./HSI).

21153 (SLAC—316, pp 111-117) **Nuclear physics at PEP recent results using the time projection chamber.** Melnikoff, S.O. (Lawrence Livermore National Lab., CA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

A preliminary result on Bose-Einstein correlations is reported using the PEP-4 Time Projection Chamber facility. The data, from scattering 14.5 GeV electrons on nuclei, was taken at the Stanford Linear Accelerator Center positron-electron (PEP) storage ring. Bose-Einstein (BE) correlations were measured from events having identified like-sign pion pairs. The particle identification and tracking capability of the Time Projection Chamber (TPC) was used to select like-sign pion pair events. The resulting correlation function for the data was fitted to a gaussian form $R(q) = 1 + \lambda \exp(-q^2\sigma^2)$ where q is the relative four-momentum difference of the pions. The fitted value of the chaoticity is λ = 0.37 +/- 0.19 and σ = 1.37 +/- 0.41 fermi. This result agrees with that from e^+e^- annihilation data taken with the TPC.

21154 (SLAC—316, pp 171-173) **Nuclear fragmentation, part II: electron-nucleus collisions at high energies.** Molitoris, J.D.; Hirsch, A.S. (Lawrence Livermore National Lab., CA (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

Some observed features of e/sup +/=/- -nucleus collisions are discussed and similarities with high energy p-nucleus collisions are outlined. A search for massive nuclear fragments (A ≧ 4) produced in these e/sup +/-/ - nucleus collisions is proposed.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

21155 **(ANL/PPRNT—89-149) /sup 12,13/C({rvec p},π/sup +-/) reactions and quasifree {rvec N}N → NNπ expectations.** Korkmaz, E.; Bland, L.C.; Jacobs, W.W.; Throwe, T.G.; Vigdor, S.E.; Green, M.C.; Jolivette, P.L.; Brown, J.D. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008337/JAW.

The analyzing power behavior and the isospin-dependence of the cross sections for near-threshold ^{13}C({rvec p},π/sup +-/) and ^{12}C({rvec p},π^+) reactions are compared with expectations from pion production measurements in free two-nucleon collisions. The general agreement for ({rvec p},π^+) suggests that the stable analyzing power pattern observed for ({rvec p},π/sup {minus}/) continuum transitions may reflect the as yet unmeasured free {rvec p}n → ppπ/sup {minus}/ behavior. We also discuss constraints imposed by quasifree {rvec N}N → NNπ expectations on the interpretation of anomalous ({rvec p},π^+) results for two strongly populated states at high excitation in /sup 13,14/C. 21 refs., 3 figs.

21156 **(INIS-mf—11372) Dispersion effects in elastic electron scattering from /sup 12/C.** Offermann, E.A.J.M. (Amsterdam Univ. (Netherlands)). 24 Feb 1988. 122p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706070/JAW.

Includes Dutch summary.

The results of an experiment, especially designed to investigate to what extent dispersion effects contribute to the reaction mechanism of elastic electron scattering from /sup 12/C, are presented and discussed. Particular attention is given to the discussion of corrections to parameters used in the calculation of the cross section. Tables of the resulting cross sections are given for the ground state and for the 2/sup +/ and 0/sup +/ states at, respectively, 4.439 and 7.655 MeV. The one-photon exchange approximation for elastic electron scattering from /sup 12/C is investigated by testing the energy dependence of the form factor in the region of the first diffraction minimum. The energy dependence observed is interpreted in terms of dispersion effects. 109 refs.; 33 figs.; 14 tabs.

21157 **(LA—11518-MS) Differential neutron production cross sections and neutron yields from stopping-length targets for 113-MeV protons.** Meier, M.M.; Amian, W.B.; Clark, D.A.; Goulding, C.A.; McClelland, J.B.; Morgan, G.L.; Moss, C.E. (Los Alamos National Lab., NM (USA)). Mar 1989. Contract W-7405-ENG-36. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008311/JAW.

We have measured differential (P,ξn) cross sections, $d^2\sigma/d\Omega dE/sub\ n/$, from thin targets and absolute neutron yields from stopping-length targets at angles of 7.5{degree}, 30{degree}, 60{degree}, and 150{degree}, for the 113--MeV proton bombardment of elemental beryllium, carbon, aluminum, iron, and depleted uranium. Additional cross-section measurements are reported for oxygen, tungsten, and lead. We used time-of-flight techniques to identify and discriminate against backgrounds and to determine the neutron energy spectrum. Comparison of the experimental data with intranuclear-cascade evaporation-model calculations with the code HETC showed discrepancies as high as a factor of 7 in the differential cross sections. These discrepancies in the differential cross sections make it possible to identify some of the good agreement seen in the stopping-length yield comparisons as fortuitous cancellation of incorrect production estimates in different energy regimes. 13 refs., 20 figs., 4 tabs.

21158 **(LBL—26460) Dielectron production in p+Be and Ca+Ca collisions at the Bevalac.** Roche, G. (Lawrence Berkeley Lab., CA (USA)). Dec 1988. Contract AC03-76SF00098;FG02-88ER40413;FG03-88ER40424;FG05-88ER40445. 13p. (CONF-8811171—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007491/JAW.

From 17. INS international symposium on nuclear physics at intermediate energies; Tokyo, Japan (15 Nov 1988).

We discuss the physics objectives of the DLS program with some emphasis on the possible use of dileptons as a probe of pion dynamics in nuclear matter. Data on p + Be reactions at 1-5 GeV and Ca + Ca at 1 GeV/A are presented. The observation of a structure at twice the pion mass in the $e^+ e/sup\ \{minus\}/$ invariant mass spectra above 2 GeV beam energy and the excitation function for the p + Be reaction suggest that pion annihilation is the main dielectron source above 2 GeV. The dielectron mass spectrum from Ca + Ca at 1 GeV/A exhibits an inverse slope larger than the one from p + Be at the same beam energy. 14 refs., 9 figs., 1 tab.

21159 (SLAC—316, pp 200-203) **(e, e'N) reactions with polarized beams and polarized targets.** Boffi, S.; Giusti, C.; Pacati, F.D. (Teorica dell'Universita, Pavia (Italy)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The quasi-free nucleon knockout by the electron is studied in the general case of both polarized beams and polarized targets. The general formalism provides nine structure functions, four of which appear only when the target nucleus is polarized. Results obtained in a nonrelativistic DWIA framework on ^{7}Li and ^{39}K for cross sections, asymmetries and electron polarization ratios are presented. The particular case is also considered of a nucleon ejected along the direction of the momentum transfer from a target with spin oriented in the same direction where only three structure functions survive and can be simply separated.

21160 **Structure of /sup 14/C via elastic and inelastic neutron scattering from /sup 13/C: Measurement and R-matrix analysis.** Resler, D.A.; Knox, H.D.; Koehler, P.E.; Lane, R.O.; Auchampaugh, G.F. (Ohio University, Athens, Ohio 45701). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 3, 766-782(Mar 1989).

Differential cross sections for neutrons elastically scattered from /sup 13/C and inelastically scattered to the first three excited states /sup 13/C/sup */(3.09, 3.68, and 3.85 MeV) were measured at 69 incident energies for $4.5 \leqq E/sub\ n/ \leqq 11$ MeV. A multiple scattering code provided a simulation of the experimental scattering process allowing accurate corrections to the small measured inelastic cross sections. The integrated /sup 13/C(n,α)/sup 10/Be cross section was determined by subtracting the sum of the measured integrated cross sections from the total. Shell-model calculations were used to generate the R-matrix parameters for the elastic and first three inelastic channels of /sup 13/C+n, and, after some minor adjustments, the predicted structure generally agreed with experiment for $E/sub\ n/ < 4$ MeV. Previous elastic /sup 13/C+n data were refitted to replace constant R_0 R-matrix background terms by more realistic broad states and to achieve better agreement with model calculations and the data. R-matrix fitting of the full data set produced new /sup 14/C level information. For $E/sub\ n/ > 4$ MeV ($E/sub\ x/ > 12$ MeV), five states were given definite J/sup π/ assignments and three states tentative assignments.

21161 **Statistical decay of fragments from C + /sup 12/C, 2.1 GeV/nucleon.** Harvey, B.G.; Crawford, H.J.; Lindstrom, P.J.; Cole, A.J. (Nuclear Science Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 3, 841-848(Mar 1989).

A statistical decay model has been used to calculate inclusive and coincidence cross sections for the formation of projectile fragments from the collision of /sup 12/C (2.1 GeV/nucleon) with a carbon target. The model predicts fragment momenta parallel and perpendicular to the projectile direction. Good agreement with experimental results is obtained for the inclusive yields of fragments and for the momenta, and fairly good agreement for coincidence yields.

21162 **Collective band structure and origin of enhanced E1 decays in /sup 18/O.** Gai, M.; Rugari, S.L.; France R.H. III; Lund, B.J.; Zhao, Z.; Bromley, D.A.; Lincoln, B.A.; Smith, W.W.; Zarcone, M.J.; Kessel, Q.C.; and others. (A.W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review Letters;* **62**: No. 8, 874-877(20 Feb 1989).

The weak $4_2^+ \rightarrow 2_3^+$ transition in /sup 18/O was observed with a branching ratio (0.30 +- 0.08)%, using the /sup 14/C(α,γ)/sup 18/O radiative-capture reaction at $E/sub\ \alpha/ = 1.14$ MeV. The corresponding $B(E2:4_2^+ \rightarrow 2_3^+) = 5.7$ +- 1.9 Weisskopf units appears noncollective, and serves as a crucial test of microscopic models predicting collective band structures and enhanced E1 decays in /sup 18/O; it is smaller by a factor of 3—8 than predictions of such models, and cannot be reproduced by the well established coexistence model for /sup 18/O, suggesting that our understanding of collective motion in light nuclei is incomplete. We review recent suggestions for extending coexistence models.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

21163 **(INIS-mf—11378) Low-spin states of /sup 23/Na.** Bakkum, E.L. (Rijksuniversiteit Utrecht (Netherlands)). 5 Nov 1987. 111p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706076/JAW.

Includes Dutch summary.

A study of /sup 23/Na via the /sup 22/Ne(p,γ)/sup 23/Na and /sup 23/Na(γ,γ)/sup 23/Na reactions is presented. Only a limited number of resonances has been studied, selected on the basis of strong excitation of the lowest levels of which the spin was unknown. As a result the spins are now known of all levels of /sup 23/Na with excitation energies up to 7 MeV, except for a few high-spin states which are too weakly excited in the decay of the known /sup 22/Ne(p,γ) resonances. The mean lifetimes of the /sup 23/Na levels at 4.43 and 7.89 MeV were found to be 350+-70 and 220+-17 attoseconds (1 attosecond = 10/sup -18/ seconds) respectively. 97 refs.; 22 figs.; 12 tabs.

21164 **(INS—711) Experimental study of /sup 20/Na and breakout off the hot-CNO cycle.** Kubono, S.; Ikeda, N.; Yasue, M. and others. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756888/JAW.

The nuclear levels above the p + /sup 19/Ne threshold in /sup 20/Na, which are critical for the breakout problem from the hot CNO cycle and the following heavy-element synthesis, have been extensively studied by the (/sup 3/He,t) and (p,n) reactions on /sup 20/Ne. Several new spin-parity assignments have been made. Specifically, the first excited state above the threshold has been identified to be 1/sup +/ at 2.637 MeV (0.438 MeV above the threshold), indicating this state to be the s-wave resonant state in the p + /sup 19/Ne scattering. The stellar reaction rate of the /sup 19/Ne(p,γ) process is evaluated for the first time based on the experimental results of /sup 20/Na, and the result is more than two orders of magnitude larger than the previous theoretical predictions. The onset temperature of the flow-out from the hot CNO cycle to heavier elements is estimated to be as low as about 2.3 x 10/sup 8/ K, suggesting that the flow-out via this process is an explanation for the strong enhancement in Ne and heavier elements in nova observations.

21165 **Fragmentation of high-spin particle-hole states in /sup 26/Mg.** Segel, R.E.; Amusa, A.; Geesaman, D.F.; Lawson, R.D.; Zeidman, B.; Olmer, C.; Bacher, A.D.; Emery, G.T.; Glover, C.W.; Nann, H.; and others. (Northwestern University, Evanston, Illinois 60204). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 3, 749-760(Mar 1989).

The inelastic scattering of 134 MeV protons to 6^- states in /sup 26/Mg has been studied. Five 6^- states were identified on the basis of their measured angular distributions and analyzing powers. By combining the results with those of companion electron scattering and (p,n) studies in /sup 26/Mg and proton studies in /sup 28/Si, it has been possible to extract isoscalar and isovector excitation amplitudes for each state.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

21166 **(ANL/PPRNT—89-150) Angular distribution for ^{56}Fe(π^+,π/sup {minus}/)^{56}Ni(DIAS).** Seidl, P.A.; Rai, G.; Gilman, R.; Morris, C.L.; Burleson, G.R.; Dhuga, K.S.; Burlein, M.; Fortune, H.T.; Zumbro, J.D.; Machuca, M.A. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008350/JAW.

We have measured a (π^+,π/sup {minus}/) angular distribution for the transition to the double isobaric analog state of a T = 2 target nucleus, ^{56}Fe, at T/sub π/ = 180 MeV. The data are compared to measurements on T = 1 targets and to theoretical predictions. The angular dependence is different from that observed in measurements on T = 1 targets. Some features of the data are reproduced by the theoretical predictions, but significant discrepancies remain. 15 refs., 3 figs., 1 tab.

21167 **(INS—713) Chromium and titanium isotopes produced in photonuclear reactions of vanadium, revisited.** Sakamoto, K.; Yoshida, M.; Kubota, Y.; Fukasawa, T.; Kunugise, A.; Hamajima, Y.; Shibata, S.; Fujiwara, I. (Kanazawa Univ. (Japan). Faculty of Science). (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1988. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756890/JAW.

Photonuclear production yields of /sup 51/Ti and /sup 51,49,48/Cr from /sup 51/V were redetermined for bremsstrahlung end-point energies (E/sub 0/) of 30 to 1000 or 1050 MeV with an aid of radiochemical separation of Cr. The yield curves for /sup 51/Ti, /sup 51/Cr, /sup 49/Cr and /sup 48/Cr show a clear evidence for two components ; one for secondary-proton reaction at E/sub 0/ < Q/sub π/+- and the other for photopion reaction, at E/sub 0/ > Q/sub π/+-, Q/sub π/+- being Q values for (γ,π/sup +/) and (γ,π/sup -/xn)-reactions. The contributions of the secondary reactions for production of the Ti and Cr isotopes at E/sub 0/ > Q/sub π/+- were then estimated by fitting a calculated secondary yields to the observed ones at E/sub 0/ < Q/sub π/+-, and found to be about 40, 20, 4 and 4 % for /sup 51/Ti, /sup 51/Cr, /sup 49/Cr and /sup 48/Cr, respectively, at E/sub 0/ = 400 to 1000 MeV. The calculation of the secondary yields was based on the excitation functions for /sup 51/V(n,p) and (p,x'n) calculated with ALICE code and the reported photoneutron and photoproton spectra from /sup 12/C and some other complex nuclei. The present results for /sup 49/Cr are very close to the reported ones, while the present /sup 48/Cr yields differ by a factor of about 50. For the /sup 51/Ti and /sup 51/Cr yields, there are some discrepancies between the present and reported ones. The yields corrected for the secondaries, in unit of μb/equivalent quantum, were unfolded into cross sections per photon, in unit of μb, as a function of monochromatic photon energy with the LOUHI-82 code. The results for the /sup 51/Ti and /sup 49/Cr are in disagreement in both the magnitude and shape with the theoretical predictions based on DWIA and PWIA. A Monte Carlo calculation does not reproduce the present result for the /sup 49/Cr yield.

21168 **(Juel-Spez—463) Emission of light charged particles in heavy ion reactions.** Buhr, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Jul 1988. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88757148/JAW.

The aim of this thesis is the study of the reaction mechanisms acting in nucleus-nucleus collisions. For this purpose two heavy-ion induced experiments were performed and evaluated. Projectiles (/sup 20/Ne and /sup 15/N) and targets (/sup 51/V and /sup 56/Fe) as well as the incident energy were in both experiments so chosen that each the whole compound-system /sup 71/As at nearly equal excitation energy of E/sub exc/ = 400 MeV was present, so that influences of the entrance channel could be studied. (HSI).

21169 **Charge-state dependence of nuclear lifetimes.** Phillips, W.R.; Ahmad, I.; Banes, D.W.; Glagola, B.G.; Henning, W.; Kutschera, W.; Rehm, K.E.; Schiffer, J.P.; Wang, T.F. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **62**: No. 9, 1025-1028(27 Feb 1989).

Measurements of conversion rates are reported for the first time in one- and two-electron systems, for the 14.4-keV nuclear state in /sup 57/Fe. The total half-life of this state deduced for the two-electron ion is 100 +- 5 ns, and that deduced for the total spin F = 1 state of the one-electron ion is 79 +- 6 ns.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

21170 (ANL-PHY—88-2, pp 227-231) **Nuclei with N = Z from germanium towards tin.** Lister, C.J.; Chishti, A.A.; Varley, B.J.; Gelletly, W.; James, A.N. (Yale Univ., New Haven, CT (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

New spectroscopic data on N = Z nuclei from Germanium to Zirconium have been collected using the Daresbury Recoil Separator. Evidence has been found for strong shell effects stabilizing oblate deformation in ^{68}Se and ^{72}Kr and strong prolate deformation (epsilon$_2$ ~ 0.4) ^{76}Sr and ^{80}Zr. Initial experiments in the N = Z = 50 region show access to ^{100}Sn will be extremely difficult for inbeam spectroscopy.

21171 (ANL-PHY—88-2, pp 232-236) **Self consistent study of very high spin properties of ^{80}Sr.** Bonche, P.; Flocard, H.; Heenen, P.H. (CEN Saclay, Gif-sur-Yvette (France)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The strontium and zirconium isotopes have been studied extensively during the last ten years both experimentally and theoretically. The interest in this mass region comes from the very rapid changes of shape that occur when the number of neutrons is varied by a few units. In a previous work, the authors have performed, a complete study of the quadrupole deformation properties of a large number of Kr, Sr, Zr and Mo isotopes by the Hartree-Fock + BCS method. Among the neutron deficient isotopes, ^{80}Sr has a particularly complicate energy surface, with three different minima (oblate, prolate and triaxial) and is very soft against γ deformations. This complicate structure has motivated them to apply the HF + cranking method already presented in a previous paper to an extensive study of the spectrum of ^{80}Sr. They shall in this communication limit themselves to the high spin region of the spectrum.

21172 (ANL-PHY—88-2, pp 302-306) **Proton-neutron interaction and nuclear deformation.** Dobaczewski, J.; Nazarewicz, W.; Skalski, J.; Werner, T.R. (Warsaw Univ. (Poland)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The supposition that the long-range n-p interaction is the main reason for the nuclear deformation was formulated long ago within the shell model [1-3]. On the other hand, the self-consistent Hartree-Fock method with realistic two-body interaction allow for a transparent analysis of the n-p effects on the nuclear deformation. Such an analysis is the topic of concern.

21173 (KURRI-TR—303, pp 7-11) **New isotope /sup 79/Y.** Mukai, J.; Nakatani, R.; Haruta, Y.; Tomura, H.; Min, B.J.; Heiguchi, K.; Suematsu, S.; Mitarai, S.; Kuroyanagi, T. (Kyushu Univ., Fukuoka (Japan). Faculty of Science). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

21174 **Preequilibrium emission and target-projectile-like correlations for /sup 20/Ne+/sup 60/Ni at E(/sup 20/Ne) = 740 MeV.** D'Onofrio, A.; del Campo, J.G.; Delaunay, B.; Delaunay, J.; Dumont, H.; Andreozzi, F.; Brondi, A.; Moro, R.; Romano, M.; Terrasi, F.; and others. (Istituto Nazionale di Fisica Nucleare, 80125 Napoli, Italy). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 3, 834-840(Mar 1989).

Inclusive γ rays at 90° and 125° and particle spectra (for Z = 1 to 6) at 14° and (Z = 1 to 4) at 120° and 150° were measured. Particle-γ-ray coincidences were obtained. Cross sections for heavy residuals were extracted from in-beam γ-ray and radioactivity measurements. Target-projectile-like correlations were well reproduced using a geometrical abrasion model plus preequilibrium and equilibrium decay.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

21175 (ANL-PHY—88-2, pp 21-25) **Spins and average quadrupole moment of the superdeformed band in ^{149}Gd and evidence for a superdeformed band in ^{148}Gd.** Flibotte, S.; Pilotte, S.; Banville, F.; Cournoyer, S.; Gascon, J.; Haas, B.; Monaro, S.; Nadon, N.; Prevost, D.; Taras, P. (Universite de Montreal, Quebec (Canada)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Approximate spins have been assigned to the superdeformed states recently observed in ^{149}Gd and an average quadrupole moment deduced. Evidence for a superdeformed band in ^{148}Gd is also reported.

21176 (ANL-PHY—88-2, pp 26-30) **Superdeformed band in ^{148}Gd: a test of shell effects in the mass 150 region.** Deleplanque, M.A.; Beausang, C.; Diamond, R.M.; McDonald, R.J.; Stephens, F.S.; Macchiavelli, A.O.; Burde, J.; Draper, J.E.; Duyar, C. (Lawrence Berkeley Lab., CA (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The search for discrete superdeformed SC bands has recently become very active. There are two regions where these bands have been found. In the lower mass region (A=100-140) eight bands have been found, six of them [1-3] in the mass 130 region, and recently, two [4] have been discovered in /sup 104,105/Pd. All these bands vary in intensity, but they seem to have similar deformation, around epsilon = 0.4. In contrast, for a long time, only one SD band was known [5] in one nucleus (^{152}Dy) in the heavier mass region around 150. In this band, the deformation was greater, around epsilon = 0.6, corresponding to a 2:1 ratio of axes. This suggested that a strong shell effect favors this band in that particular nucleus. Contrary to this hypothesis, a second SD band has recently been found [6] in ^{149}Gd. This report presents a new SD band found in an even-even nucleus of this region, ^{148}Gd. The intensity and moments of inertia of these SD bands will be discussed and compared, suggesting that the band in ^{152}Dy may be unique.

21177 (ANL-PHY—88-2, pp 46-51) **Search for superdeformation in ^{146}Gd and ^{180}Os.** Rzaca-Urban, T.; Gast, W.; Hebbinghaus, G.; Kraemer-Flecken, A.; Lieder, R.M.; Schnare, H.; Senff, C.; Thoms, M.; Urban, W.; de Angelis, G. (Institut fuer Kernphysik, Juelich (Germany, F.R.)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Prolate superdeformation at high spins has been the subject of extensive studies during the last few years. Theoretical calculations using the Strutinsky shell correction method, suggested the most favored particle numbers to find superdeformed nuclei of intermediate mass to be Z=64 and N=86. Since superdeformation in nuclei is understood as due to shell effects it appeared interesting to study possible occurrence of superdeformed structures in the extreme case of the doubly-magic nucleus ^{146}Gd, which is nearly spherical at low spins, and in ^{180}Os, which has a proton configuration similar to that of the neutrons causing superdeformation in the Gd-Dy region.

21178 (ANL-PHY—88-2, pp 53-57) **Intrinsic structure of the superdeformed band in ^{132}Ce.** Tanabe, K.; Sugawara-Tanabe, K. (Saitama Univ. (Japan)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A description is presented of the superdeformed band in $_{58}$/^{132}Ce$_{74}$ with the fully self-consistent solution to the cranked HFB equation. Since many highlying or lowlying spherical levels become relevant at large prolate deformation, a wide range of spherical Nilsson basis has been detailed covering almost three

major shells for both protons and neutrons outside the assumed core of Z/sub c/ =28 and N/sub c/ = 50.

21179 (ANL-PHY—88-2, pp 58-62) **Quadrupole moment of superdeformed band in ^{135}Nd.** Diamond, R.M.; Deleplanque, M.A.; McDonald, R.J.; Stephens, F.S.; Macchiavelli, A.O.; Bacelar, J.; Burde, J.; Draper, J.L.; Duyar, C. (Lawrence Berkeley Lab., CA (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A preliminary value was obtained for the Q/sub o/ of the SD band in ^{135}Nd, Q/sub o/ = 7 +/- 1 barns, significantly less than the value obtained for the band in ^{132}Ce, Q/sub o/ = 8.8 barns. These quadrupole moments lead to values of epsilon of 0.03 and 0.38 for ^{135}Nd and ^{132}Ce. The values of the moments of inertia are rather similar, suggesting similar deformations. This may be an indication that the pairing correlations are more heavily reduced in the ^{135}Nd SD band than in the ^{132}Ce one.

21180 (ANL-PHY—88-2, pp 63-67) **Superdeformation in the A = 130-140 region.** Nolan, P.J.; Bishop, P.J.; He, Y.; Godfrey, M.J.; Jenkins, I.; Kirwan, A.; Wadsworth, R.; Hughes, R.; Mullins, S.M.; Love, D.J.G. (Univ. of Liverpool (England)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The bands in the cerium-neodymium region have deformations less than those seen in the dysprosium region. The underlying physics appears to be similar. Cases studied in both regions exhibit dominant effects of a few particles in high spin orbitals. These together with the rotation induce a stable high deformation minimum in the potential energy surface.

21181 (ANL-PHY—88-2, pp 68-72) **Role of the deformation-driving ν i/sub 13/2/ [660]1/2$^+$ intruder orbital in A ~ 130 nuclei.** Ma, R.; Beausang, C.W.; Paul, E.S.; Piel, W.F. Jr.; Shi, S.; Xu, N.; Fossan, D.B.; Zhang, Z.Y. (State of Univ. of New York, Stony Brook (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

States in ^{137}Sm were populated via the ^{104}Pd(^{37}Cl,p3nγ) reaction at 170 MeV. The heavy-ion beams were provided by the Stony Brook Superconducting LINAC. Both thick and thin targets where used. The decay scheme of ^{137}Sm deduced from this work is presented with the decoupled (Omega = 1/2) ν i/sub 13/2/ band. At low spins, the yrast band (3) of ^{137}Sm is based on a coupled neutron orbital from the upper h/sub 11/2/ midshell. Two further coupled band structures consisting of relatively strong dipole transitions were observed at higher spins.

21182 (ANL-PHY—88-2, pp 83-93) **Superdeformation - perspectives.** Twin, P.J. (Univ. of Liverpool (England)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The existence in nuclei of a stable superdeformed shape at high spin is well established. The increasing number of examples has shown variations in the properties of the superdeformed bands. As each new feature is explained the next observation highlights a new phenomena. The net result is a rapidly evolving subject which is dramatically increasing the authors understanding of rapidly rotating nuclei.

21183 (ANL-PHY—88-2, pp 100-105) **Octupole correlations in Ba and Ce isotopes.** Phillips, W.R.; Ahmad, I.; Emling, H.; Holzmann, R.; Janssens, R.V.F.; Khoo, T.L.; Drigert, M.W. (Univ. of Manchester (England)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Partial decay schemes for the very neutron-rich nuclei /sup 144,146/Ba and /sup 146,148,150/Ce have been determined by the study of γ-γ coincidences in ^{252}Cf fission fragments. The level sequences and enhanced E1 transition rates in ^{144}Ba, ^{146}Ba and ^{146}Ce indicate strong octupole correlations, in agreement with the predictions of cranked mean-field calculations.

21184 (ANL-PHY—88-2, pp 106-110) **Reflection asymmetry and fission yields near mass 145.** Walters, W.B.; Robertson, J.D. (Univ. of Maryland, College Park (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Some new data is presented on level schemes of ^{143}Ba and ^{147}Ce and then their relationship to the whole question of reflection asymmetric structure in this mass region and others is discussed. These experiments followed the initial study of the level structure of ^{145}Ba where maximum effect from reflection asymmetry was predicted by Leander et al. From the level scheme of ^{145}Ba, it could easily be seen that the expected parity doublet structure was absent. Moreover, the levels were so far apart that it was clear that no highly deformed rotational band is built on the known 5/2 ground state. A highly decoupled band is possible, but the moments for that band constructed by Leander are far from the experimental values measured by Mueller. It was also difficult to follow the development of these levels without better knowledge of the level schemes of the adjacent isotope, ^{143}Ba, or isotone ^{147}Ce. To this end, both of these level schemes were investigated at the TRISTAN facility in Brookhaven National Laboratory.

21185 (ANL-PHY—88-2, pp 126-129) **Study of octupole nuclei using Coulomb excitation and heavy ion transfer reactions.** Butler, P.A.; Jones, G.D.; Poynter, R.J.; White, C.A.; Hoare, T.H.; Cunningham, R.A.; Connell, K.A.; Simpson, J.; Warner, D.; Hughes, J.R. (Univ. of Liverpool (England)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The nuclei ^{148}Nd and ^{224}Ra, which lie in the regions of strong octupole correlation near Z ~ 56, N ~ 90 and Z ~ 90 N ~ 134 respectively, have been studied using quasi elastic heavy ion reactions. In these experiments carried out at the NSF Daresbury, γ-rays were observed in the 24 detector POLYTESSA array and coincidence backscattered projectile-like fragments were detected using a large solid angle position sensitive avalanche detector, positioned within the nucleus of POLYTESSA.

21186 (ANL-PHY—88-2, pp 139-155) **Correlations in the unresolved γ-ray spectra.** Stephens, F.S. (Lawrence Berkeley Lab., CA (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The unresolved part of the γ-ray spectra following heavy-ion fusion (and other) reactions has represented a challenge to nuclear scientists for many years. It seems that there may now be some real progress on this problem, as the author has realized that damping is very likely playing an important role in these spectra. The author wants to spend most of his time describing this development, beginning with what rotational damping is and why it is interesting. The evidence for such damping will be discussed in the second section; and in the third, he will tell about motional narrowing - one aspect of the damping that they do not understand at all well at the present time. Finally he will mention a new way to look at these unresolved spectra by measuring the number of rotational bands that are involved.

21187 (ANL-PHY—88-2, pp 195-200) **Shape changes and giant dipole resonances in hot rotating nuclei.** Alhassid, Y. (Yale Univ., New Haven, CT (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Experimental information on the shapes of hot rotating nuclei is becoming available through the study of the Giant Dipole Resonances (GDR) built on highly excited nuclei. A unified mean-field theory is presented that is based on the Landau theory of phase transitions in statistical systems. The phenomenological parameters which appears in the Landau expansion are then extracted from microscopic calculations. Their systematics has been studied in the rare nuclei. Shape fluctuations are not negligible in finite nuclear systems and affect the GDR. A macroscopic theory is presented which takes into account thermal fluctuations in all five quadrupole degrees of freedom of a hot nucleus.

21188 (ANL-PHY—88-2, pp 247-251) **Influence of nuclear deformation on the proton evaporation from compound nuclei.** Mueller, L.; Ecker, R.; Friese, J.; Rosner, G.; Zeitelhack, K.; Koerner, H.J. (Technische Universitaet Muenchen, Garching (Germany, F.R.)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Charged particles evaporated from hot rotating nuclei may serve as probes to explore the shape of the emitting source. One example is the recent investigation of alpha-gamma angular correlations in compound reactions performed in the Oak Ridge spin spectrometer. In this contributions we present the first results from an experiment designed to study the angular correlation of two successively evaporated protons measured in coincidence. The experimental conditions are chosen in such a way that an enhanced transmission probability, say from the pole tips of a prolate deformed nucleus, would enlarge the observed anisotropies considerably. The angular distribution of light particles evaporated from hot rotating nuclei is determined by transmission coefficients and the available phase space. Therefore the emission of particles perpendicular to the angular momentum vector is preferred: in this way the angular momentum and energy of the emitted particle is taken from the rotational degree of freedom, and the decay proceeds to a daughter nucleus in the state of highest level density.

21189 (ANL-PHY—88-2, pp 257-261) **Superdeformed bands in Pd nuclei.** Macchiavelli, A.O.; Burde, J.; Diamond, R.M.; Beausang, C.W.; Deleplanque, M.A.; McDonald, R.J.; Stephens, F.S.; Draper, J.E. (Lawrence Berkeley Lab., CA (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Not much is yet known about the actual properties of superdeformed bands, such as their single-particle configuration, pairing correlations and their population and decay mechanisms. It is important, at this stage, to determine experimentally the regions where superdeformation occurs. In this meeting the authors report the discovery of two rotational bands, one in ^{104}Pd and one in ^{105}PD, that can be interpreted as originating from a second minimum in the potential energy surface of these nuclei at large deformations. This is a new mass region where discrete superdeformed bands have been found at high spins, the other known regions being in Gd-Dy nuclei around mass 150 and in the light Cd-Nd nuclei.

21190 (ANL-PHY—88-2, pp 262-264) **Coincidence RDM measurement in ^{132}Ce: no prealignment below backbending.** Pakkanen, A.; Lampinen, A.; Hattula, J.; Julin, R.; Juutinen, S.; Loennroth, T.; Virtanen, A.; Fahlander, C.; Chowdhury, P. (Univ. of Jyvaeskylae (Finland)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The cerium isotopes are γ-soft transitional nuclei which have large shape changes at high spin. Earlier lifetime measurements for /sup 130,132/Ce suggest a peculiar prealignment effect where transition rates in the ground state band are gradually reduced, already before strong fluctuations in the backbending region at J=10-12. However, a complicated time distribution of side feeding can cause large errors in experimental results and therefore lifetimes in ^{132}Ce were measured using a coincidence recoil distance method. Level scheme of ^{132}Ce is presented.

21191 (IAEA-TECDOC—483, pp 255-268) **Measurement and analysis of continuous spectra from inelastic neutron scattering on /sup 93/Nb in the energy range 7 to 14 MeV.** Mittag, S.; Schmidt, D.; Seeliger, D. (Technische Univ., Dresden (German Democratic Republic)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Continuous emission spectra from the /sup 93/Nb(n,n') reaction were measured at bombarding energies E/sub 0/=7.0, 9.0 and 12.3 MeV. Attention especially was connected with investigation of the high energy spectrum. Including earlier measurement at E/sub 0/=14.6 MeV, a theoretical analysis of angle-integrated spectra as well as angular distributions has been carried out. It could be shown that the single-particle exciton model is not able to explain in the full incident energy range the high-energetic tail of experimental spectra observed, i.e. the pre-equilibrium processes. A further component must be included, which is relevant to collective excitation and which is based on the direct reaction theory. (author). 48 refs, 10 figs.

21192 **(INIS-mf—11366) Study of the giant dipole resonance built on highly excited states in Sn and Dy nuclei.** Stolk, A. (Vrije Univ., Amsterdam (Netherlands)). 24 May 1988. 149p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706064/JAW.

Includes Dutch summary.

A study is presented of the giant dipole resonance built on highly excited states. The aim is to get more detailed information on the properties of the GDR and to use it as a tool for the investigation of nuclear structure at high excitation energy. The high energy γ-rays seen from the decay of excited state GDRs in heavy ion fusion reactions reflect the average properties of the states populated by the γ-emission. The measurements at different initial excitation energies of /sup 114/Sn provide information on the nuclear level density near the particle separation energy at an average angular momentum of 10Planck constant. The study of shape changes at very high spin in /sup 152-156/Dy nuclei is presented. A theoretical model developed to describe fusion-evaporation reactions is presented. 149 refs.; 63 figs.; 13 tabs.

21193 (KURRI-TR—303, pp 30-33) **Identification of the new isotope /sup 121/La and decay spectroscopy of /sup 122,124,126/La and /sup 128,130/Pr.** Iimura, H.; Ichikawa, S.; Oshima, M.; Sekine, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

21194 (KURRI-TR—303, pp 40-44) **Q/sub β/ measurements with an LEPS.** Ukon, H.; Miyachi, M.; Shibata, M.; Yamamoto, H.; Kawade, K.; Katoh, T.; Kawase, Y.; Okano, K.; Ruan, J.Z. (Nagoya Univ. (Japan). Faculty of Engineering). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

21195 (SLAC—316, pp 169-170) **Nuclear fragmentation, part I: proton-nucleus collisions at high energies.** Hirsch, A.S.; Molitoris, J. (Purdue Univ., West Lafayette, IN (USA)). May 1987. NTIS, PC A 11. Order Number DE88010766/JAW. (CONF-870165—).

From Workshop on electronuclear physics with internal targets; Stanford, CA, USA (5 Jan 1987).

The features of p-nucleus collisions leading to the production of nuclear fragments are briefly reviewed. Emphasis is placed on what is known and what is unknown experimentally.

21196 **/sup 64/Ni +/sup 92/Zr fission yields at energies close to the Coulomb barrier.** Wolfs, F.L.H.; Janssens, R.V.F.; Holzmann, R.; Khoo, T.L.; Ma, W.C.; Sanders, S.J. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 865-872(Mar 1989).

Fission yields for the /sup 64/Ni+/sup 92/Zr reaction at laboratory energies between 240 and 300 MeV have been measured. "Elastic scattering" angular distributions were also obtained and used to deduce the generalized total reaction cross sections. The competition between fission and light-particle evaporation from the compound nucleus is well reproduced by statistical-model calculations. However, the calculated neutron multiplicities for this reaction are larger than those previously measured. Possible reasons for this discrepancy are discussed.

21197 **Identification of /sup 181/Pb in /sup 40/Ca irradiations of /sup 144/Sm.** Toth, K.S.; Moltz, D.M.; Robertson, J.D. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 1150-1153(Mar 1989).

The isotope /sup 181/Pb was identified in /sup 40/Ca irradiations of /sup 144/Sm via its α-decay properties: E/sub α/ = 7.044 +- 0.015 MeV, and T/sub 1/2/ = 50/sub -30//sup +40/ ms. The assignment was based on excitation-function and cross-bombardment (/sup 39/K+/sup 147/Sm and /sup 40/Ca+/sup 147/Sm) information and on decay-energy systematics. Also, in the course of the /sup 40/Ca+/sup 147/Sm measurements, two α groups that have not been reported previously were assigned to /sup 183/Pb α decay. The observation of these α groups necessitates a correction to the adopted mass of /sup 183/Pb.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

21198 (ANL-PHY—88-2, pp 31-35) **Superdeformed band in ^{151}Dy.** Janssens, R.V.F.; Rathke, G.E.; Drigert, M.W.; Ahmad, I.; Beard, K.; Chasman, R.R.; Garg, U.; Hass, M.; Khoo, L.; Koerner, H.J. 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A rotational band of 19 (possibly 20) transitions extending to spin ~ 131/2 h has been observed in ^{151}Dy with an average dynamic moment of inertia F/sup (2)/ = 79 h MeV^{-1}. This band is identified as a superdeformed band in ^{151}Dy. The value of F/sup (2)/ agrees with cranked Strutinsky calculations. Similarities as well as striking differences with the superdeformed bands of neighboring nuclei are observed.

21199 (ANL-PHY—88-2, pp 36-40) **Superdeformed band in ^{178}Os?.** Burde, J.; Macchiavelli, A.O.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S.; Beausang, C.W.; McDonald, R.J.; Draper, J.E. (Hebrew Univ. of Jerusalem (Israel)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The discovery of an unusual band in ^{178}Os is reported. It is the first time that a discrete band has been seen with a large moment of inertia J/sup (2)/ which corresponds closely to that of the superdeformed band in ^{152}Dy after an A/sup 5/3/ normalization on the one hand, but with a small J/sup (1)/ value on the other. Furthermore, this band connects directly to the yrast band.

21200 (ANL-PHY—88-2, pp 41-45) **Search for discrete line superdeformed bands in ^{126}Ba and ^{184}Pt.** Waddington, J.C.; Johansson, J.K.; Rajnauth, D.; Tucker, D.; Andrews, H.R.; Ball, G.C.; Horn, D.; Radford, D.C.; Ward, D.; Carpenter, M.P. (McMaster Univ., Hamilton, Ontario (Canada)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

During the past two years, discrete line transitions have been found in superdeformed bands from Cerium to Dysprosium. The present experiment is an attempt to study the extreme ends of this region of nuclei by investigating ^{126}Ba and ^{184}Pt. Beams from the TASCC facility at Chalk River were used, with ^{126}Ba being populated through the ^{96}Zr(^{34}S,4n) reaction at 155 MeV and the ^{160}Gd(^{29}Si,5n) reaction at 151 MeV was used to populate ^{184}Pt.

21201 (ANL-PHY—88-2, pp 73-77) **Hyperdeformed nuclei and the residual pseudo-su(3) symmetry.** Dudek, J.; Werner, T. (Joint Institute for Heavy Ion Research, Oak Ridge, TN (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The superdeformed bands found in discrete transitions in rare earth nuclei are becoming more abundant now including /sup 148,149,150/Gd and /sup 151,152/Dy. The corresponding quadrupole deformations are expected to be typically within β_2 ~ (0.55 to 0.65) range which, for the nuclei in question can be translated into quadrupole moments of Q ~ 18 eb or B(E2) ~ 2300 W.u. The latter, compared typically to B(E2) ~ 250 W.u. in the normal deformed nuclei, signifies an order of magnitude faster transitions in the exotic, superdeformed shapes. Yet, the calculations performed indicate that even more exotic, elongated nuclear shapes may be found soon in nature. These shapes, called hyperdeformed, are expected to have β_2 ~ (0.9 to 1.2) which corresponds to the B(E2) values approaching ~ 10,000 W.u. In terms of the axis ratios, a:b, such shapes may be visualized as extremely elongated forms with a slight necking and a:b varying from 2.5:1 to 3.5:1.

21202 (ANL-PHY—88-2, pp 156-159) **Rotational damping widths of individual nuclei.** Vydrug-Vlasenko, S.; Broglia, R.A.; Dossing, T.; Ormand, W.E. (Univ. of Copenhagen (Denmark)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A realistic evaluation is presented of the dispersion σ/sub omega/ in rotational frequency among basis bands. The basis bands are here taken as mean field states, and this ansatz has not yet been rigorously justified. The rotational frequencies are calculated starting from single particle states in a cranked Nilsson potential. This allows for taking into account the shell structure of individual nuclei, and, in principle, for including fluctuations in the nuclear shape. For low temperatures the rotational damping width is predicted to be proportional to σ /sub omega/, Gamma/sub rot/ ~ 5σ/sub omega/. Above a certain temperature, motional narrowing is expected to set in and reduce the rotational damping width relative to this value.

21203 (ANL-PHY—88-2, pp 160-163) **High resolution correlation studies of continuum gamma rays of ^{170}Hf.** Lee, I.Y.; Baktash, C.; Beene, J.R.; Halbert, M.L.; Hensley, D.C.; Johnson, N.R.; McGowan, F.K.; Riley, M.A. (Oak Ridge National Lab., TN (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A high resolution gamma-gamma energy correlation study of ^{170}Hf was performed using 18 anti-Compton shielded Ge detectors in the Spin Spectrometer along with 52 NaI elements. The fusion reaction ^{130}Te + ^{44}Ca was produced with a 200 MeV ^{44}Ca beam from the HHIRF tandem accelerator. A total of 5 x 10^8 two- and higher-fold Ge coincidence events, along with the associated information from the 52 NaI detectors of the Spin Spectrometer were recorded. The data were first corrected for the variation in gains of the detectors and then the total pulse height of the gamma ray (H) and the coincidence fold (k) for each event were calculated. From these data, the spin and excitation energy dependence of the correlation properties of the continuum gamma rays were extracted.

21204 (ANL-PHY—88-2, pp 164-168) **Quasicontinuum γ rays in /sup 152,154,156/Dy.** Holzmann, R.; Ahmad, I.; Dichter, B.; Emling, H.; Janssens, R.V.F.; Khoo, T.L.; Ma, W.C.; Drigert, M.W.; Garg, U.; Daly, P.J. 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The evolution of the γ-ray quasicontinuum with increasing neutron number has been investigated in the sequence of dysprosium isotopes /sup 152,154,156/Dy. A well pronounced E2 component is displayed by all of the three nuclei, but only ^{154}Dy shows a splitting of the E2 bump into two distinct parts which are both shown to be of collective nature. The E2 and statistical components could be reproduced in simple γ cascade calculations. While this was possible in ^{152}Dy and ^{156}Dy by including solely rotational bands in the model, the structure observed in ^{154}Dy could be fitted only with additional quasi-vibrational transitions.

21205 (ANL-PHY—88-2, pp 169-173) **Finite-temperature Hartree-Fock-Bogoliubov cranking calculations in ^{158}Yb.** Goodman, A.L. (Tulane Univ., New Orleans, LA (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The FTHFBC equation is solved for the transitional nucleus ^{158}Yb for temperatures 0-2MeV and spins 0-60h. The deformation and pair gaps are determined as functions of spin and temperature. At a spin-dependent critical temperature there is a transition from prolate collective rotation to oblate noncollective rotation. For spins above 39h, the most probable (i.e., FTHFBC) phase at all temperatures is oblate noncollective rotation. However with increasing temperature, the statistical shape fluctuations create an average phase of prolate collective rotation.

21206 (ANL-PHY—88-2, pp 174-177) **G-Factors above the second backbend in /sup 158,160/Yb.** Kluge, H.; Grawe, H.; Mahnke, H.E.; Reviol, W. (Hahn-Meitner-Institut, Berlin (Germany, F.R.)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The irregularities in the yrast line of deformed even-even nuclei, extensively studied in a great number of nuclei during the last decade, are understood as the crossing of a band by another band that contains two quasiparticles whose angular momenta are aligned with the rotational axis. So far, the character of the quasiparticles, i.e. whether neutrons or protons are involved, has been deduced mainly from blocking arguments based on a cranked shell model interpretation. Only for the first backbend in some nuclei a direct method like the g-factor measurement has been successfully applied confirming the assignment of an i/sub 13/2/ neutron alignment to this irregularity. The difficulties to obtain these data originate from the short nuclear lifetimes and the population of these states. The authors report on the first g-factor measurements for states above the second backbend in /sup 158,160/Yb. Due to the short lifetimes of the levels of interest, the method of integral spin precession on unresolved transitions in a transient magnetic field has been used. The application of unresolved spectroscopy was successfully demonstrated for ^{162}Yb supporting the picture of the alignment of two i/sub 13/2/ neutrons for the first backbend.

21207 (ANL-PHY—88-2, pp 179-194) **Continuum gamma rays from low and high temperatures.** Herskind, B.; Gaardhoje, J.J.; Schiffer, K. (Univ. of Copenhagen (Denmark)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

In this Slide Report on continuum gamma ray spectra the experiments the authors group in Copenhagen have been involved in recently in collaboration with groups from England, France, Italy, Germany and Holland are summarized. The total set of experiments cover the full temperature and angular momentum space that nuclei can accommodate as a collective body. The different experiments were designed to address specific problems and give new information about: (1) Rotational damping from triple gamma correlations by higher selectivity on rotational transitions. (2) Shape evolutions and fluctuations at finite temperatures as function of spin. (I/sub max/ ~ 30h) by GDR measurements. (3) Shape evolution and fluctuations at finite temperature as function of spin (I/sub max/ ~ 60h) and also test for superdeformed shapes by angular correlation effects. (4) The shape of the nuclear potential at a temperature of T = 3.5 MeV, where thermal equilibrium still may be expected before the GDR decay, by accurate measurements of the width. Does Motional Narrowing effect the width? (5) The limits of collective motion at even higher temperatures up to T ~ 7MeV where nuclei still are observed with full momentum transfers.

21208 (ANL-PHY—88-2, pp 201-205) **Triaxial shape of yrast states in odd-a nuclei.** Hamamoto, I. (Univ. of Lund (Sweden)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

In the yrast spectroscopy of odd-A nuclei the observed quantities, which are especially useful for the study of possible triaxial shape, are the signature-dependence of B(E2:I → I-1)-values, signature-splitting of energies, B(M1:I → I-1)/B(E2:I → I-2) ratios, B(E2:I → I-1)/B(E2:I → I-2) ratios and absolute magnitudes of B(E2:I → I-2)-values. For example, in nuclei with Z = 67, 69 and 71 a number of those available data with good accuracy are now available. For simplicity, the author restricts himself to the negative- (positive-) parity yrast-states in odd-Z (odd-N) rare-earth nuclei, in which odd-particle lies in the j=ħ/sub 11/2/ (i/sub 13/2/) orbits. Thus, the favored (unfavored) signature is defined by α/sub f/ = 1/2(-1)/sup j-1/2/ (α/sub u/ = 1/2(-1)/sup j+1/2/) and the corresponding total angular momentum is I=α mod 2. In the following they pick up three kinds of data for discussion, with an emphasis on the question of the reliability of the analysis based on the cranking (CR) approximation.

21209 (ANL-PHY—88-2, pp 206-210) **Rotational bands in ^{157}Ho.** Radford, D.C.; Andrews, H.R.; Horn, D.; Ward, D.; Banville, F.; Flibotte, S.; Taras, P.; Johanssen, J.S.; Tucker, D.; Waddington, J.C. (Atomic Energy of Canada Limited, Chalk River, Ontario). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The rotational band structure of ^{157}Ho has been extensively studied with γ-γ coincidences from the 8π spectrometer at Chalk River. The previous work of Simpson et al is in large part confirmed. Almost 200 new transitions and at least five new bands are assigned. The structure of these new bands is discussed.

21210 (ANL-PHY—88-2, pp 211-215) **Alignments, shape changes, band terminations and transitions rates in ^{157}Tm.** Riley, M.A.; Baktash, C.; Ellis-Akovali, Y.A.; Halbert, M.L.; Hensley, D.C.; Johnson, N.R.; Lee, I.Y.; McGowan, F.K.; Janzen, V.P.; Riedinger, L.L. (Oak Ridge National Lab., TN (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The even-even N = 88 nuclei ^{158}Yb, ^{156}Er and ^{154}Dy have been well studied at high spin and there is evidence for a shape transition from prolate to oblate shapes (band termination) between spins I ~ 30 - 42. It is important to study this shape transition in an odd-Z isotone since a particular systematic trend is expected and also because odd-Z nuclei possess special characteristics not found in the even-even cases. High spin states in ^{157}Tm were populated via the ^{110}Pd(^{51}V,4n) reaction at a beam energy of 220 MeV. Gamma rays were detected in coincidence by using the authors detector Compton Suppression System. Approximately 165 million events were recorded.

21211 (ANL-PHY—88-2, pp 216-221) **Rotational band crossings and shape changes in light Ir nuclei.** Janzen, V.P.; Bingham, C.R.; Carpenter, M.; Hart, K.; Jin, H.Q.; Riedinger, L.L.; Schmitz, W.; Zhou, L.; Rajnauth, D.D.; Johansson, J.K. (Univ. of Tennessee, Knoxville (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

21212 (ANL-PHY—88-2, pp 221-225) **Shape co-existence in ^{180}Hg.** Dracoulis, G.D.; Stuchbery, A.E.; Asputin, R.; Macchiavelli, A.O.; Beausang, C.W.; Burde, J.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S. (Australian National Univ., Canberra). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Excited state in ^{180}Hg have been identified. The day pattern observed is indicative of shape co-existence similar to that known in the heavier isotopes. The prolate deformed band is higher in energy, relative to the oblate band, than in ^{182}Hg, establishing a clear minimum in the prolate-oblate energy difference near N = 103.

21213 (ANL-PHY—88-2, pp 237-241) **Transfer reactions between heavy ions.** Wu, C.Y.; Liu, X.T.; Kernan, W.J.; Cline, D.; Czosnyka, T.; Guidry, M.W.; Kavka, A.E.; Kincaid, R.W.; Kotlinski, B.; Sorensen, S.P.; Vogt, E. (Univ. of Rochester, NY (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Single-nucleon and two-nucleon transfer reactions are the preeminent probes of single-particle structure and pairing correlations in nuclei. For many years light-ion induced transfer reactions have played an important role in the study of nuclear structure. Recently, a new class of transfer reactions; namely transfer reactions between heavy ions (A > 40), has emerged. This class of transfer reactions provides a laboratory for studying transfer between high-spin states of deformed nuclei, populated by Coulomb excitation prior to transfer, and as such are a new probe of single-particle structure and pairing correlations under the influence of considerable collective angular momentum. These reactions also provide a unique population mechanism for studying high-spin states. This paper describes measurements of one and two neutron transfer reactions for Ni and Sn projectiles bombarding Dy at energies near the Coulomb barrier. The results illustrate that heavy-ion induced transfer reactions are a powerful addition to the arsenal for studying high-spin physics. In particular, exciting results have been obtained from their studies of two-neutron transfer.

21214 (ANL-PHY—88-2, pp 242-246) **Two-neutron transfer reactions with heavy-deformed nuclei.** Price, C.; Landowne, S.; Esbensen, H. 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

In a recent communication it was pointed out that one can combine the macroscopic model for two-particle transfer reactions on deformed nuclei with the sudden limit approximation for rotational excitation and thereby obtain a practical method for calculating transfer reactions leading to high-spin states. As an example, the authors presented results for the reaction ^{162}Dy(^{58}Ni, ^{60}Ni) ^{160}Dy populating the ground-state rotational band up to the spin $I = 14^+$ state. The validity was tested of the sudden limit for the inelastic excitation of high spin states and they have noted how the macroscopic model may be modified to allow for more microscopic nuclear structure effects in an application to diabolic pair-transfer processes. Subsequent work is described which the systematic features are investigated of pair-transfer reactions within the macroscopic model by using heavier projectile to generate higher spins and by decomposing the cross sections according to the multipolarity of the transfer interaction. Particular attention is paid to characteristic structures in the angular distributions for the lower spin states and how they depend on the angular momentum carried by the transferred particles.

21215 (ANL-PHY—88-2, pp 252-256) **Population of high spin states by deep inelastic and quasielastic collisions.** Saladin, J.X. (Univ. of Pittsburgh, PA (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Thus far, high spin studies have been for the most part limited to neutron deficient nuclei. It is obviously desirable to extend such studies to neutron rich nuclei. The following is a report on an exploratory experiment using deep inelastic and quasielastic collisions for populating high spin states. An ^{170}Er target was bombarded with a 220 MeV ^{22}Ne beam from the K500 cyclotron at NSCL. The energy, charge and mass of the projectile-like fragments (PLF) were determined by six surface barrier ΔE-E telescopes located at an angle of 30° relative to the beam direction. γ rays were detected with the Pittsburgh multi detector array, which at the time of the experiment consisted of five Compton suppressed, high purity Ge detectors and a 14 element BGO sum-multiplicity spectrometer (SMS). From the measured γ-multiplicates and excitation energies, it is possible to derive the intrinsic spin I/sub i/ of the system (i.e., the sum of the intrinsic spins of the PLF and the target-like fragment (TLF) just after the collision was derived.

21216 (ANL-PHY—88-2, pp 265-269) **Unusual decays of high-K isomers: penetration of soft barriers in the β - γ landscape.** Chowdhury, P.; Fabricius, B.; Christensen, C.; Azgui, F.; Bjornholm, S.; Borggreen, J.; Holm, A.; Pedersen, J.; Sletten, G.; Bentley, M.A. (Yale Univ., New Haven, CT (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The existence and decay modes of high-spin isomers in prolate, deformed nuclei are directly connected to the high degree of symmetry of the nuclear shape. Since the projection, K, of the angular momentum onto the nuclear symmetry axis is approximately a good quantum number, high-seniority high-K configurations are often isomeric with long lifetimes. K-selection rules lead to stepwise decays of these isomers through intermediate-K states and eventual population of low-K states at low spins. The Hf-W-Os region is rich in such isomers, because of the occurrence of many high-Omega orbitals for both protons and neutrons near the Fermi surface. A search at high-spin in this region, had revealed isomers in OS nuclei which decayed in flagrant violation of the usual K-selection rules, with a high multiplicity of γ-rays and populating rotation-aligned low-K bands at high-spins. Without a detailed knowledge of the decay pattern, the presence of a spectrum of triaxial rotor levels had been suggested as a fast decay route for the isomer to high-spin members of the yrast band.

21217 (ANL-PHY—88-2, pp 270-274) **G-Factor of the K=25 isomer in ^{182}Os.** Alderson, A.; Broude, C.; Bruce, A.; Dafni, E.; Fallon, P.; Goldring, G.; Hass, M.; Nyberg, J.; Roberts, J.; Sharpey-Schafer, J. (Univ. of Liverpool (England)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The g-factor of the K=I=25, 120 ns isomer in ^{182}Os has been measured by observing the angular precession of the decay γ-rays in an external magnetic field. The authors preliminary result is g=0.46(5). Comparing the result to predictions based on experimental g-factors of single-particle Nilsson orbitals in this mass region suggests equal contributions of neutron and proton spin to the total spin of I=25. An attempt has also been undertaken to measure the quadrupole moment of this level by observing the time-dependent quadrupole interaction pattern of Os nuclei recoiling into an Os single crystal. The analysis of the quadrupole moment measurement, as well as a more detailed analysis of the g-factor measurement, is now in progress.

21218 (ANL-PHY—88-2, pp 275-279) **Microscopic calculation of g-factors, backbending and isotope shift in Er isotopes from A=158 to 170.** Sugawara-Tanabe, K.; Tanabe, K. (Univ. of Tokyo (Japan)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A systematic analysis is performed of g-factors and energy levels along the yrast line over Er isotopes on the basis of self-consistent calculation. To investigate the detailed behavior of the g-factors which are sensitive to the single-particle properties around the fermi surface the cranked HFB (CHFB) approximation is applied.

21219 (ANL-PHY—88-2, pp 280-284) **Band structure studies in /sup 187,189,191/T l.** Goettig, L.; Beard, K.B.; Drigert, M.W.; Morsad, A.; Garg, U.; Ahmad, I.; Holzmann, R.; Janssens, R.V.F.; Khoo, T.L.; Ma, W.C. (Univ. of Notre Dame, IN (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The structure of the light-mass Tl(Z=81) nuclei has been a puzzle ever since the discovery of strongly-coupled bands built on $9/2^-$ states in these single proton-hole nuclei near the Z=82 closed proton shell. These bands are now viewed as one of the best-known families of shell model intruder states. An often-noted feature of these bands has been the remarkably constant level spacings over a wide range of Tl nuclei whereas the $9/2^-$ state itself plunges in excitation energy with decreasing mass number--the apparent increase in deformation indicated by this plunge in the bandhead energies is not consistent with the constant moments of inertia implied by the similar band spacings. In a recent laser hyperfine structure (LHS) measurement, however, it was concluded that the quadrupole moments of the $9/2^-$ states do not change with the neutron number; the constant moments of inertia were sought to be explained in terms of a compensating contribution from pairing. With the aim of attempting to solve this puzzle in a direct way, the lifetimes were measured for the members of the $9/2^-$ bands in a number of light-mass Tl nuclei. From the B(E2) values extracted from these measurements, it would be possible to obtain the quadrupole moments independent of the LHS measurements.

21220 (ANL-PHY—88-2, pp 285-287) **Effects of the high-j rotating quasiparticle orbits on the superdeformed states.** Chen, Y.S. (Institute of Atomic Energy, Beijing (China)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The effects of high-j quasiparticle orbits on the superdeformed states are discussed. The calculated strong deformed yrast states of A $\approx$ 130 nuclei indicates the importance of the vi13/2 quasiparticle β-driving. Calculations for the rare earth nuclei suggests the existence of the superdeformed N=80-88 isotope chain which may be attributed to the onset of the rotating high-j orbits such as vj15/2.

21221 (ANL-PHY—88-2, pp 292-296) **Doubly-decoupled bands in odd-odd Re nuclei: experimental results compared with IBFFA calculations.** Chou, W.T.; Olivier, W.A.; Aryaeinejad, R.; McHarris, W.C.; Scholten, O. (Michigan State Univ., East Lansing (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

A partial level scheme for ^{174}Re is presented that was obtained via in-beam γ-ray studies of the ^{159}Tb(^{20}Ne,5nγ) ^{174}Re reaction with a 114-MeV ^{20}Ne beam from the NSCL K500 cyclotron. Similarly, a partial level scheme is given for ^{176}Re obtained by a parallel set of experiments with the ^{159}Tb(^{22}Ne,5nγ) ^{176}Re reaction, using a 110-MeV ^{22}Ne beam. IBFFA predictions are compared with the experimental bands. The calculations predict the $5^+ \rightarrow 3^+$ spacing to be 45.7 keV, consistent with such a γ-ray not having been observed. The calculated spacings are too small, primarily because of problems in fitting a K = 1/2 band in the odd-mass nuclei (a problem inherent in all calculations). Nevertheless, the calculations correctly predict the bandhead as 3^+, correctly predict the configuration, and predict the wrong signature states to be shifted upward by roughly 20 keV.

21222 (ANL-PHY—88-2, pp 297-301) **Additivity of odd N and odd Z effects in deformed doubly odd nuclei.** Kreiner, A.J. (Centre de Recherches Nucleaires, Strasbourg (France)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The study of near yrast states in double odd IR, Re and Ta nuclei is starting to reveal a wealth of new and interesting structures. These structures depart drastically from a normal rotational behavior due to strong Coriolis effects. Just one example is the so called double decoupled band (DDB) in which both valence proton and neutron occupy predominantly Omega = 1/2 orbitals ($1/2^-$[541] (h/sub 9/2/) and $1/2^-$[521] respectively) with large decoupling parameters (a $\geq$ 1).

21223 **(GSI—89-11-Prepr.) Investigation of neutron-rich rare-earth nuclei including the new isotopes /sup 177/Tm and /sup 184/Lu.** Rykaczewski, K.; Gippert, K.L.; Runte, E.; Schmidt-Ott, W.D.; Tidemand-Petersson, P.; Kaffrell, N.; Kirchner, R.; Klepper, O.; Koslowsky, V.T.; Roeckl, E. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej; Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.; Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej; Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.; Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie; Politechnika Warszawska (Poland). Inst. Fizyki). Jan 1989. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757128/JAW.

Decays of neutron-rich isotopes in the rare-earth region were studied by means of on-line mass separation and β-γ spectroscopy using multinucleon-transfer reactions between beams of /sup 136/Xe (9 and 11.7 MeV/u), /sup 186/W (11.7 and 15 MeV/u) and /sup 238/U (11.4 MeV/u) and targets of /sup nat/W and Ta. The higher beam energies appear to be advantageous for the production of such isotopes. Two new isotopes were identified: /sup 177/Tm with a half-life T/sub 1/2/ = 85+-10/15 s, and /sup 184/Lu with T/sub 1/2/ $\cong$ 18 s. A new 47 s-activity found at A = 171 is tentatively assigned to the decay of the new isotope /sup 171/Ho. The properties of the ground and excited states of neutron-rich lanthanide isotopes are interpreted within the shell model using the deformed Woods-Saxon potential. A change of the ground-state configuration for odd-mass neutron-rich lutetium isotopes from π 7/2/ sup +/ [404] to π 9/2/sup -/ [514] is suggested, this change being due to the influence of a large hexadecapole deformation. The role of a possible isometric state in /sup 180/Lu for the nucleosynthesis of /sup 180m/Ta is discussed.

21224 (KURRI-TR—303, pp 20-23) **Nuclear polarization with laser optical pumping and its application to nuclear structure study.** Matsuki, S. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

21225 (KURRI-TR—303, pp 45-48) **Source preparation using radio ion chromatography.** Shibata, M.; Miyachi, M.; Ukon, H.; Yamamoto, H.; Kawade, K.; Katoh, T.; Ruan, J.Z.; Nagahara, T.; Tamai, T. (Nagoya Univ. (Japan). Faculty of Engineering). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

21226 **Nuclear-structure dependence of heavy-ion-fusion partial-wave distributions.** Kuehn, W.; Ruckelshausen, A.; Fischer, R.D.; Breitbach, G.; Hennrich, H.J.; Metag, V.; Novotny, R.; Janssens, R.V.F.; Khoo, T.L.; Habs, D.; and others. (II. Physikalisches Institut, Universitaet Geissen, Geissen, West Germany). *Physical Review Letters;* **62**: No. 10, 1103-1105(6 Mar 1989).

Partial-wave cross sections for fusion of /sup 64/Ni+/sup 92/Zr and /sup 64/Ni+/sup 96/Zr at energies of 5% and 7% above the Bass-model fusion barrier have been measured with the Darmstadt-Heidelberg Crystal Ball. The distribution for fusion with the more neutron-deficient target /sup 92/Zr exhausts the unitarity limit for lower angular momenta. In contrast, fusion with the slight-

ly more neutron-rich target /sup 96/Zr yields a broad angular momentum distribution with cross sections well below unitarity even for small partial waves.

21227 **Nucleon exchange and heat partition in damped collisions.** Pl-dash-baraneta, R.; Kwiatkowski, K.; Zhou, S.H.; Viola, V.E.; Breuer, H.; McMahan, M.A.; Randrup, J.; Mignerey, A.C. (Department of Chemistry and Indiana University Cyclotron Facility, Indiana University, Bloomington, Indiana 47405). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 1197-1200(Mar 1989).

Mass and charge distributions have been measured for damped projectile-like fragments in the reaction /sup 74/Ge+/sup 165/Ho at 8.5 MeV per nucleon bombarding energy. Coincidences were measured between angle-correlated reaction partners in order to derive the primary mass distribution and the excitation energy distribution for projectile-like fragments. The evolution of the primary N and Z distributions as a function of energy loss is found to deviate significantly from predictions of the nucleon exchange transport model. The fraction of excitation energy residing in the projectile-like fragment is shown to depend both upon energy loss and the direction of the nucleon flow.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

21228 **(GSI—89-03-Prepr.) Transverse momentum distributions of neutral pions from central and peripheral /sup 16/O+Au collisions at 200 A GeV.** Albrecht, R.; Bock, R.; Gutbrod, H.H.; Kolb, B.W.; Lund, I.; Schmidt, H.R.; Siemiarczuk, T.; Awes, T.C.; Baktash, C.; Ferguson, R.L.; WA80 Collaboration. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). (Oak Ridge National Lab., TN (USA); Muenster Univ. (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Lund Univ. (Sweden); Lawrence Berkeley Lab., CA (USA)). Jan 1989. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756942/JAW.

The production of neutral pions by the interaction of 200 A GeV protons and /sup 16/O projectiles with a Au target has been studied in the pseudorapidity range 1.5≦eta≦2.1. Transverse momentum spectra have been measured between 0.4 GeV/c and 2.8 GeV/c and their dependence on the centrality of the collision has been investigated. The data show a high degree of similarity to p+p and α+α data from the ISR. The peripheral-collision spectra display a marked change of slope with a hard component starting at about 1.8 GeV/c, in contrast to central-collision data.

21229 **(GSI—89-04-Prepr.) Fluctuations in multi-particle production and γ/π/sup 0/-ratios in 200 A GeV /sup 16/O+Au collisions.** Lund, I.; Albrecht, R.; Bock, R.; Claesson, G.; Gutbrod, H.H.; Kolb, B.W.; Schmidt, H.R.; Siemiarczuk, T.; Awes, T.C.; Baktash, C.; WA80 Collaboration. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); Lund Univ. (Sweden); Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). Jan 1989. 20p. (CONF-8811172—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756943/JAW.

From Conference: hadron structure '88; Piestany, Czechoslovakia (14 Nov 1988).

Preliminary data from 200 A GeV /sup 16/O+Au reactions are presented. A study of the fluctuations in the particle density in the pseudo-rapidity interval 2.4≦eta≦4.0 reveals non-statistical fluctuations down to Δeta=0.1. We discuss the possible consequences of this observation. A preliminary analysis of the γ/π/sup 0/-ratio in the pseudorapidity interval 1.5≦eta≦2.1 results in an excess over known photon sources for the central reactions. No excess is seen in peripheral reactions. We describe the method of analysis and outline the forthcoming investigations.

21230 **(GSI—89-05-Prepr.) Correlations of neutral pions in ultrarelativistic heavy ion collisions.** Peitzmann, T.; Beckmann, P.; Berger, F.; Glewing, G.; Dragon, L.; Glasow, R.; Kampert, K.H.; Loehner, H.; Purschke, M.; Santo, R.; WA80 Collaboration. (Muenster Univ. (Germany, F.R.)). (Muenster Univ. (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Oak Ridge National Lab., TN (USA); Lund Univ. (Sweden); Lawrence Berkeley Lab., CA (USA)). Jan 1989. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756944/JAW.

Correlations of 4 photons representing neutral pions have been studied in ultrarelativistic heavy ion collisions. Data were taken in the WA80 experiment at the CERN-SPS with a 200 A GeV oxygen beam. The π/sup 0/ are detected via their decay photons with a high-granularity lead glass array. Special features of interferometry using neutral pions will be discussed. The extracted preliminary parameters for high p/sub T/ pions emitted near midrapidity in O+Au collisions lead to rather small effective source sizes.

21231 **Pb(n,n'x) at 65 MeV and the isospin structure of the giant quadrupole resonance region.** Hjort, E.L.; Brady, F.P.; Romero, J.L.; Drummond, J.R.; Hamilton, M.A.; McEachern, B.; Smith, R.D.; Brown, V.R.; Petrovich, F.; Madsen, V.A.; and others. (Crocker Nuclear Laboratory and Physics Department, University of California, Davis, California 95616). *Physical Review Letters;* **62**: No. 8, 870-873(20 Feb 1989).

The first Pb(n,n'x) data (at 65 MeV) are compared to earlier (61— MeV) (p,p'x) data. The isovector sensitivity of these nucleon probes is used to determine M/sub n//M/sub p/≅N/Z = 1.54 for the giant quadrupole resonance (GQR). This result is consistent with other direct GQR measurements, 2_1^+ data connected through core polarization, and several microscopic random-phase approximation calculations, but in disagreement with a π^-/π^+ study which gives M/sub n//M/sub p/ = 3.8 +- 1.2. .AE

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

21232 (ANL-PHY—88-2, pp 78-82) **γ-decay of the shape isomer in ^{236}U.** Schirmer, J.; Gerl, J.; Habs, D.; Schwalm, D. (Physikalisches Institut Universitaet Heidelberg (Germany, F.R.)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The first direct observation of the γ-decay shape isomers was reported by Russo et al. in 1975, who observed two single γ-lines carrying most of the transition energy and deduced a branching ratio /sub Gamma t absolute value II//sup Gamma gamma/ ≈ 16 for the decay of the shape isomer in /sup 238 m/U. First experiments have been performed for /sup 236m/U. Excited states in ^{236}U were produced by the ^{235}U(d,p)^{22}&U reaction, bombarding a metallic ^{235}U target. Two dominant γ-cascades are observed depopulating the shape isomer via two known 1- level sin the first minimum ^{236}U at excitation energies of E*=688 keV and E*=967 keV, respectively.

21233 (ANL-PHY—88-2, pp 95-99) **Octupole degree of freedom in the radium isotopes.** Robledo, L.M.; Egido, J.L. (Universidad Autonoma, Madrid (Spain)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The octupole degree of freedom of the nuclei /sup 216-230/Ra is analyzed in the frame of the constrained Hartree-Fock plus BCS(HFBCS) theory with Gogny forces. The authors show octupole barrier heights and the B(E1) transition probabilities together with other properties. The agreement with the available experimental results is very good.

21234 (ANL-PHY—88-2, pp 111-115) **Does ^{218}Ra remain octupole deformed at very high spin?.** Aieche, M.; Schulz, N.; Vanin, V.; Chevallier, A.; Chevallier, J.; Sens, J.C.; Dudek, J.; Briancon, C.; Ruchowska, E.; Fernandez-Niello, J. (Universite Louis Pastuer, Strasbourg (France)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Experimental studies of light actinide nuclei give results compatible with octupole deformed shapes. Cranked mean field calculations reproduce the characteristic features of the corresponding high spin spectra and were used to investigate the possible deformation changes with increasing angular momentum. Theory predicts that for the lightest nuclei the effects of octupole deformation persist up to very high spins, whereas in several nuclei having already an octupole deformation in their ground state a transition to a reflection symmetric shape is expected for $I > 20$ h. In this context, the authors investigated ^{218}Ra to higher spins than the previously known 16^+ and 17^- levels.

21235 (ANL-PHY—88-2, pp 116-120) **Transition rates in ^{218}Ra: enhanced dipole decays and quadrupole collectivity.** Gai, M. (Yale Univ., New Haven, CT (USA)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

Recent studies of the Ra-Th nuclei and of ^{218}Ra in particular revealed an interesting structure including states of alternating parities linked by enhanced E1 decays. These bands were then naturally interpreted as indicating the occurrence of reflection asymmetry in these nuclei. Two such models incorporating reflection asymmetry were suggested, the cluster model and the stable octupole model. Both models predict the data with equal success.

21236 (ANL-PHY—88-2, pp 121-125) **Octupole deformed Th nuclei.** Habs, D.; Schwalm, D.; Schwartz, B.; Dahlinger, M.; Kankeleit, E.; Simon, R.S.; Backe, H.; Burrows, J.D.; Butler, P.A. (Universitaet Heidelberg (Germany, F.R.)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

During the last years a wealth of spectroscopic data have been accumulated on neutron-deficient Ra and Th nuclei, showing that many of their gross features can be explained in terms of a reflection asymmetric shape. Earlier studies of even-even /sup 220,222/Th to higher spins have been extended. The level scheme of ^{223}Th has been established. For the first time, a sequence of parity doublets was observed up to high spins in an odd nucleus, a feature for reflection asymmetric nuclei. All Th nuclei were produced via the reactions ^{208}Pb (/sup 16.18/O, xn). Due to the large fission competition a positive identification of the surviving evaporation residues with an electrostatic separator was necessary in order to obtain clean γ-ray and conversion electron spectra.

21237 (ANL-PHY—88-2, pp 130-137) **Static versus dynamic octupole distortions in ^{222}Ra.** Barranco, F.; Broglia, R.A.; Vigezzi, E. (Escuela Superior de Ingenicros Industriales, Sevilla (Spain)). 1988. NTIS, PC A 15. Order Number DE88013968/JAW. (CONF-880496—).

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The role played by the octupole degree of freedom in ^{222}Ra is studied making use of a model of large amplitude nuclear motion, which takes into account the superfluid dynamics of the observed adiabatic motion. In the case of the superfluid nucleus ^{222}Ra, and within the superfluid tunneling model, the question of whether the system displays dynamic or static octupole deformations is decided by the potential energy surface. The variety of microscopic calculations of this quantity lead to splittings between odd- and even-parity bands which within a factor of 2 are consistent with the experimental data, and to solutions which are strongly anharmonic, or with wavefunctions localized at the octupole minima.

21238 **(DOE/ER/40475—1) Fission cross section measurement of Cm-247, Es-254 and Cf-250: Progress report.** Block, R.C. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering and Engineering Physics). 1 Mar 1989. Contract FG02-88ER40475. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008583/JAW.

The Rensselaer Intense Neutron Spectrometer (RINS) system has been activated to measure the fission cross sections of microgram quantities of transuranic nuclei. The fast electronics have been tested with spontaneous fission pulses from the Cf-252-coated electrodes in the fission chamber used for the Cm-242 and Pu-238 measurements by Alam et al.; six chains of electronics, each consisting of a preamplifier, power filter, fast amplifier and fast discriminator, are now working and available to take data. 3 refs.

21239 **(GSI—89-03) Spectroscopy study after quasi-elastic collision in the system /sup 208/Pb+/sup 232/Th at an incident energy of 17 MeV per nucleon.** Happ, T. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.)). Jan 1989. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757126/JAW.

In the present thesis by means of a particle-particle-γ and particle-particle-neutron coincidence experiment γ and neutron spectroscopic studies after quasi-elastic collisions at incident energies far above the Coulomb barrier were performed. For the study of the γ decay by the necessary correction of the Doppler shift the possibility results to study excitations in the projectile and in the target. So in the case of /sup 232/Th beside the observation of the ground state band up to the spin 14 Planck constant also a very large number of transitions from vibrational side bands. From the spectra the γ emission probabilities in dependence on the distance of closest approximation were extracted. (orig./HSI).

21240 **(INDC(BZL)—25) Graphical representation of some evaluated neutron cross-sections from INDL/A-83.** Moraes, M. de; Paviotti Corcuera, R. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Dec 1988. 33p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705489/JAW.

The graphical representations of the evaluated neutron cross section from INDL/A-83 which were in the ENDF/B-V format are presented. The total, elastic, inelastic, capture, and fission cross sections are given for fifteen nuclides in the range 10/sup -5/ to 15 Mev or 20 Mev depending on the data given for the evaluation. (author). 2 refs, 1 tab.

21241 **(INDC(BZL)—29) Validation of actinide nuclear data from ENDF/B-V, INDL/A-83 and JENDL-2.** Paviotti Corcuera, R.; Moraes, M. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Nov 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705491/JAW.

Resonance integrals and fission spectrum averaged cross sections are calculated for the actinides of ENDF/B-V, INDL/A-83 and JENDL-2. The results are compared with each other and with experimental data when available. The experimental data are scarce and there exist large differences among data from different libraries. (author). 16 refs, 4 tabs.

21242 (KURRI-TR—303, pp 49-53) **Study of transuranium elements by using JAERI tandem accelerator.** Shinohara, N. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 20259, 21007, 21099, 21143, 21143, 21148, 21150, 21160, 21161, 21191, 21196, 21227, 21241, 21241, 21347, 21430

21243 **(CTA-IEAV-NT—03/86) MADNIX a code to calculate prompt fission neutron spectra and average prompt neutron multiplicities.** Merchant, A.C. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Mar 1986. 41p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705416/JAW.

A code has been written and tested on the CDC Cyber-170 to calculate the prompt fission neutron spectrum, N(E), as a function of both the fissioning nucleus and its excitation energy. In this note a brief description of the underlying physical principles involved and a detailed explanation of the required input data (together with a sample output for the fission of /sup 235/U induced by 14 MeV neutrons) are presented. Weisskopf's standard nuclear evaporation theory provides the basis for the calculation. Two important refinements are that the distribution of fission-fragment residual nuclear temperature and the cooling of the fragments as neutrons are emitted approximately taken into account, and also the energy dependence of the cross section for the inverse process of compound nucleus formation is included. This approach is then used to calculate the average number of prompt neutrons emitted per fission, v-bar/sub p/. At high excitation energies, where fission is still possible after neutron emission, the consequences of the competition between first, second and third chance fission on N(E) and v-bar/sub p/ are calculated. Excellent agreement with all the examples given in the original work of Madland and Nix is obtained.

21244 **(CTA-IEAV-NT—011/86) Comparison of averaged actinide cross sections weighted by the Madland - Nix and the NBS spectrum.** Corcuera, R.P.; Moraes, M. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Aug 1986. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705421/JAW.

Two weighting functions are used to average actinide cross sections. The results are compared to experimental values.

21245 **(GSI—88-70-Prepr.) Diabatic shifts and fluctuations of heavy-ion fusion barriers.** Berdichevsky, D.; Lukasiak, A.; Noerenberg, W.; Rozmej, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 2 Dec 1988. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756938/JAW.

The fusion process for heavy nuclei is studied within a generalized formulation of the diabatic approach to collective nuclear motion. It is shown that the coupled equations of motion decouple during the approach if appropriate diabatic channels are used. Thus the mean value and the variance of the barrier are completely determined from an ensemble of diabatic channel barriers, the ensemble being defined by the initial correlations. The mean shift with respect to the adiabatic barrier and the variance are calculated from the splitting of the diabatic single-particle levels at the barrier and the initial occupation probabilities given by the pairing wavefunctions of the separated nuclei. Results are presented for 23 systems of nuclei with masses around 100. Comparison with experimental data shows good agreement, in particular also for the isotopic trends. Additional effects from the destruction of pairing correlations and the diabatic screening of the fusion pocket for heavier nuclei with Z/sub 1/Z/sub 2/ > or approx. 2000 are discussed.

21246 **(GSI—89-02-Prepr.) Relativistic mean-field description of nuclei and nuclear dynamics.** Reinhard, P.G. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik). Jan 1989. 139p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756941/JAW.

The relativistic mean-field model of the nucleus is reviewed. It describes the nucleus as a system of Dirac-Nucleons which interact in a relativistic covariant manner via meson fields. The meson fields are treated as mean fields, i.e. as non quantal c-number fields. The effects of the Dirac sea of the nucleons is neglected. The model is interpreted as a phenomenological ansatz providing a self-consistent relativistic description of nuclei and nuclear dynamics. It is viewed, so to say, as the relativistic generalisation of the Skyrme-Hartree-Fock ansatz. The capability and the limitations of the model to describe nuclear properties are discussed. Recent applications to spherical and deformed nuclei and to nuclear dynamics are presented.

21247 **(HMI-B—459) Evolution of direct mechanisms with incident energy from the Coulomb-barrier to relativistic energies. - Two-center effects in nucleon transfer between nuclei. - Signatures of nucleon promotion in heavy ion reactions at barrier energies.** Oertzen, W. von; Voit, H.; Imanishi, B. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik). Oct 1988. 32p. (CONF-880795—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757129/JAW.

From Tokyo symposium on heavy-ion and nuclear astrophysical problems; Tokyo, Japan (19 Jul 1988).

This report contains a review article considering the evolution of direct mechanisms with incident energy in heavy ion reactions and two theoretical articles concerning two-center effects in transfer reactions between heavy ions and the nucleon promotion in heavy ion reactions. See hints under the relevant topics. (HSI).

21248 (IAEA-TECDOC—483, pp 122-130) **Comparison of combinatorial and thermodynamic methods of calculating nuclear level densities.** Ignatyuk, A.V.; Lunev, V.P.; Shubin, Yu.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The paper analyses the errors in microscopic methods of calculating nuclear level densities, errors due to various approximations of quasiparticle and collective excitation spectra. (author). 13 refs, 6 figs.

21249 (IAEA-TECDOC—483, pp 131-133) **Nuclear level density formula with low energy correction.** Lu Haitao. (Guizhou Univ., Guiyang (China)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Based on the recommended level density formula of the Fermi gas model, considering the modification at low excitation energies, a level density formula is proposed. From the experimental data of mean neutron resonance spacing D-exp and cumulative number of levels No(E) for 264 nuclei, a set of suitable parameters is determined. With these parameters the calculated values agree very well with the experimental data. (author). 4 refs, 1 tab.

21250 (IAEA-TECDOC—483, pp 236-243) **Microscopic combinatorial approach to quasi-particle state density in deformed nuclei.** Reffo, G.; Herman, M. (ENEA, Bologna (Italy)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A microscopic combinatorial approach is used to investigate the influence of the nuclear deformation on the distributions of quasi-particle states. It is shown that nuclear deformation tends to suppress strong fluctuations observed in similar calculations performed in the space of spherical shell-model s.p.s. The dependence of the pairing effects on the deformation is analysed. The applicability of the formula by Williams is examined and found to be only

valid for strongly deformed medium and heavy nuclei. (author). 7 refs, 10 figs.

21251 (IAEA-TECDOC—483, pp 243-245) **Pauli exclusion effect in multiparticle and hole state densities. Summary.** Zhang Jingshang. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A method to calculate the effect of the Pauli exclusion principle in multiparticle and hole state densities is proposed. The model-independent method can be essentially extended to any multi-fermion system. For an application to the exciton model, both the strict expression of state densities and the exact Pauli exclusion correction are obtained in the equidistant spacing model. The enhancement of the exact Pauli exclusion correction implies that the Pauli exclusion principle plays a quite important role in state densities. 2 tabs.

21252 **(IAEA-TECDOC—483) Nuclear theory for fast neutron nuclear data evaluation. Proceedings of an advisory group meeting held in Beijing, 12-16 October 1987.** (International Atomic Energy Agency, Vienna (Austria)). Nov 1988. 312p. (CONF-8710181—). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW.

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The proceedings contain all invited and contributed papers presented at the Advisory Group Meeting on Nuclear Theory for Fast Neutron Data Evaluation held in Beijing 12-16 October 1987, as well as the conclusions and recommendations and the Chairman's summary of the meeting. The meeting presentations have been divided into six sessions devoted to the following topics: introductory speech (1 paper), optical potential (9 papers), compound nuclear theory (10 papers), pre-compound nuclear theory (13 papers), isomeric cross-section (1 paper) and intercomparison of nuclear model computer codes (1 paper). A separate abstract was prepared for each of these papers. Refs, figs and tabs.

21253 (IAEA-TECDOC—483, pp 37-47) **Requirements of theoretical evaluations.** Vonach, H. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The paper discusses the need for the use of nuclear theory in evaluation work, the way in which nuclear theory should be used in conjunction with the existing experimental data in order to achieve the most accurate results and the problem of uncertainty estimates of theoretically calculated cross-sections. It is shown that the comparison of different evaluations provides a very simple and general method to derive such uncertainty estimates. Finally it is pointed out that the almost simultaneous completion of new evaluated data files in U.S., Japan and Western Europe expected for next year together with the continuing evaluation work in China and Russia will provide a unique chance for such comparisons in near future. (author). 11 refs, 10 figs.

21254 (IAEA-TECDOC—483, pp 51-61) **Neutron optical model potential.** Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The present status of optical model calculations of neutron scattering and interactions is reviewed, with special emphasis on more recent developments and the more promising lines of research. The use of dispersion relations to provide an extra constraint on the potential is discussed, together with their application to studies of the Fermi surface anomaly. The application of potential inversion techniques to determine the form of the potential is also considered. (author). 39 refs, figs.

21255 (IAEA-TECDOC—483, pp 61-73) **Semi-microscopic theory of the nucleon optical potential based on effective interactions - from non-relativistic to relativistic.** Gu Yingqi; Han Yinlu; Ma Zhongyu; Shen Qingbiao; Tian Ye; Zhang Jingshang; Zhu Ping; Zhuo Yizhong. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Both non-relativistic and relativistic optical potentials are studied by utilizing effective Skyrme interactions and effective Lagrangian based on Walecka model, respectively. The first and second order mass operators of one-particle Green function in nuclear matter are derived and applied within the local density approximation (LDA) to finite nuclei. From a rather extensive comparison with experimental data of various quantities of interests, it is concluded that the obtained microscopic optical potentials have good predictive capability to be applied to nuclear data evaluations when experimental data are lacking. (author). 27 refs, 8 figs, 1 tab.

21256 (IAEA-TECDOC—483, pp 73-76) **Use of the multi-channel coupling method for the neutron strength function description.** Ignatyuk, A.V.; Lunev, V.P.; Pronyaev, V.G.; Trykov, E.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Neutron cross sections in the iron region were calculated in the framework of the multi-channel coupling method. Channels dominating in the formation of the optical potential imaginary part were taken into account. This approach allows the consistent description of s-, p- and d-neutron strength functions to be reached as well the total cross sections for low energy neutrons. (author). 13 refs, 2 figs, 1 tab.

21257 (IAEA-TECDOC—483, pp 77-80) **Direct inelastic scattering and nuclear collective excitation.** Liu Dunhuan; Zhou Hongmo; Zhang Xiaochen. (Wuhan Univ. (China); Nankai Univ., TJ (China)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Using the DWBA theory the differential cross section for inelastic scattering of neutrons has been calculated. In order to calculate neutron nuclear data the computer program has been made. (author). 9 refs, 5 figs.

21258 (IAEA-TECDOC—483, pp 80-85) **Preliminary medium energy nucleon-nucleus phenomenological optical model potential.** Madland, D.G. (Los Alamos National Lab., NM (USA)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Initial results are presented for the determination of a medium-energy nucleon-nucleus phenomenological optical-model potential. The starting point for this work is the phenomenological optical-model potential of Schwandt et al., which is based on measured elastic scattering cross sections and analyzing powers for polarized protons ranging from 80 to 180 MeV. This potential is modified optimally to reproduce experimental proton reaction cross sections for /sup 27/Al, /sup 56/Fe, and /sup 208/Pb, as a function

of energy, while allowing only minimal deterioration in the fits to the elastic cross sections and analyzing powers. Further modifications in the absorptive potential were found necessary to extrapolate the modified potential to higher energies. The final potential is converted to a neutron-nucleus potential by use of standard Lane model assumptions and by accounting approximately for the Coulomb correction. Comparisons of measured and calculated proton reaction and neutron total cross sections are presented for /sup 56/Fe. (author). 4 refs, 7 figs.

21259 (IAEA-TECDOC—483, pp 85-94) **New parametrization of the optical model potential for neutron reactions.** Konshin, O.V. (Belorusskij Gosudarstvennyj Univ., Minsk). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Analysis of experimental data available within the framework of the optical model showed that a deep minimum in the total cross-sections at energies below 3 MeV as well as level excitation functions for nuclei with A=40/60 cannot be reproduced by existing parametrizations. The information on single-particle state energies as the extrapolation of the optical potential to the negative energy region was included in the analysis made. As a result, a new optical model parametrization is proposed. (author). 31 refs, 13 figs.

21260 (IAEA-TECDOC—483, pp 94-101) **(p,n) reaction and the optical model.** Conde, H. (Uppsala Univ. (Sweden). Dept. of Neutron Research). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Optical model calculations for neutron and proton scattering and (p,n)-reactions are compared with recent experimental results. In particular, the influence of the nuclear structure on the calculation of the (p,n)-reaction cross section is highlighted. Use of the (p,n)- and (n,p)-reactions for studies of isovector excitations is discussed and recent results are given. Plans are presented of (n,p) cross section measurements at The Svedberg Laboratory, Uppsala University. (author). 25 refs, 7 figs.

21261 (IAEA-TECDOC—483, pp 101-104) **Complex method and its application to the automatic adjustment of optical model parameters.** Zhou Hongmo; Yu Ziqiang; Zhang Xiaocheng; Zuo Yixin. (Nankai Univ., TJ (China)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

An outline of the complex method and its application to the automatic adjustment of optical model parameters is given. (author). 2 figs.

21262 (IAEA-TECDOC—483, pp 104-106) **Optical model analysis of fast neutron scattering from /sup 6/Li.** Zhu Yaoyin; Zhang Yujun; Hui Ruifa; Liu Manfen. (Jilin Univ., Changchun (China)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A systematic optical model analysis of fast neutron scattering from /sup 6/Li was given. The optical model potential of Woods-Saxon form was used in analysis, considering the linear energy dependence of the real-well diffuseness. Comparison between the calculated results and the experimental data was given. (author). 4 refs, 2 figs.

21263 (IAEA-TECDOC—483, pp 109-121) **Recent progress in compound nuclear theory and the calculation of resonance averaged cross-sections.** Froehner, F.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The recent years have seen a breakthrough in Hauser-Feshbach theory. Resonance-averaged partial cross sections including width fluctuation corrections and elastic enhancement can now be calculated exactly in the framework of the level-statistical theory of compound-nuclear reactions (i.e. for Hamilton matrices from the Gaussian Orthogonal Ensemble). A more general approach employing entropy maximisation has established the probability distributions for the R- and S-matrix, from which resonance-averaged cross sections can also be calculated. Both avenues lead to practically the same numerical results. Applications to coherent evaluation by simultaneous fitting of cross sections data for all open reaction channels in the unresolved-resonance region are presented. Problems with self-shielded resonance-averaged group cross sections are briefly addressed. (author). 53 refs, 5 figs, 1 tab.

21264 (IAEA-TECDOC—483, pp 164-167) **Correlation of nuclear parameters in Hauser-Feshbach model formula estimated from experimental cross-section data.** Kanda, Y.; Uenohara, Y.; Tsuji, H. (Kyushu Univ., Fukuoka (Japan). Dept. of Energy Conversion Engineering). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Correlation of nuclear parameters, level density parameters, pairing energies and optical model parameters, in Hauser-Feshbach model formula have been estimated from experimental data of neutron-induced reactions for Co and Ni. Correlation matrices for the level density parameter resulted from three cases of different combination of the nuclear parameters are compared to discuss the effect of parameters in the formula. The correlation of reaction cross sections calculated from the estimated parameters is compared with the one obtained in the new evaluation from both differential and integral experiments. (author). 5 refs, 3 figs.

21265 (IAEA-TECDOC—483, pp 167-171) **Calculation of neutron cross-sections of /sup 64,66,68/Zn for fusion applications.** Young, P.G.; Rutherford, D.A. (Los Alamos National Lab., NM (USA); New Mexico Univ., Albuquerque (USA). Dept. of Chemical and Nuclear Engineering). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Hauser-Feshbach statistical theory calculations are described for neutron reactions with /sup 64/Zn, /sup 66/Zn, and /sup 68/Zn over the energy range 0.01-20 MeV. A neutron spherical optical potential is obtained by fitting neutron total cross sections and elastic angular distributions, together with low-energy resonance data. Preequilibrium effects are calculated with an exciton model, and direct reaction effects are included through DWBA calculations using deformation parameters from (p,p') scattering. The results are compared to experimental data, including new measurements of /sup 64/Zn(n,p)/sup 64/Cu and /sup 64/Zn(n,2n)/sup 63/Zn cross sections at 14.8 MeV. (author). 20 refs, 5 figs, 2 tabs.

21266 (IAEA-TECDOC—483, pp 172-189) **Recent advances in nuclear structure studies related to neutron and photon processes.** Fabbri, F.; Maino, G.; Menapace, E.; Mengoni, A. (ENEA, Bologna (Italy)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Some recent results are discussed about nucleon cross section and photon production calculations in connection with nuclear structure studies. (author). 57 refs, 11 figs, 2 tabs.

21267 (IAEA-TECDOC—483, pp 190-192) **Unified model of (n,γ) reaction and calculations of neutron induced photon production data.** Ho Yukun; Liu Jingfeng. (Fudan Univ., Shanghai, SH (China). Dept. of Nuclear Science; Zhengzhou Univ., HEN (China). Dept. of Physics). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The mechanism of radiative neutron capture reaction is classified and reviewed accordingly to the hierarchy of quasi-particle number in the excited configurations. A unified model to calculate (n,γ) cross sections is studied. Underlain by the model, a computer code to calculate neutron induced photon production data has been developed. Some results of using this program are illustrated and compared with measured data. (author). 3 figs.

21268 (IAEA-TECDOC—483, pp 195-203) **Recent developments and applications for precompound nuclear theory.** Blann, M. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

New considerations on consistent effective level densities for precompound decay are reviewed and tested for the hybrid model formulation. The importance of using realistic single particle levels for few quasi-particle densities is illustrated via (p,n) reactions on four Zr isotope targets. Some review is given of combinations of precompound plus Hauser-Feshbach approaches. The status of semi-classical and quantal approaches to calculating angular distributions is also discussed. We present comparisons of experimental and calculated angular distributions, particle spectra and excitation functions for reactions with nucleons and heavy ions up to and beyond 100 MeV, as examples of data being requested by modern technology. (author). 43 refs, 15 figs.

21269 (IAEA-TECDOC—483, pp 204-214) **Recent developments in exciton and unified models.** Gruppelaar, H.; Akkermans, J.M. (Netherlands Energy Research Foundation, Petten). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A review is given of the recent developments of the exciton model in its master-equation formulation. Progress has been made in the modelling and the calculation of angular distributions, gamma-ray emission, particle-hole level densities, preformation factors for complex particle emission and two-fermion models. The most interesting development, however, is the integration of precompound and compound models by including angular-momentum conservation. At present this unified model is successful in predicting angle-integrated quantities. It is essentially equivalent to the quantal multi-step compound models, but it has some computational advantages. We discuss possibilities for further integration of precompound and compound models on a quantum-mechanical basis and suggest some directions for future work. (author). 49 refs, 8 figs.

21270 (IAEA-TECDOC—483, pp 214-223) **Multistep compound processes in nuclear reactions.** Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The quantum-mechanical theory of multistep compound reactions due to Feshbach, Kerman and Koonin is reviewed and applied to the analysis of reactions of neutrons with /sup 59/Co, /sup 93/Nb and /sup 209/Bi. A detailed study is made of reactions at MeV, and in addition the total cross-sections in several reaction channels are presented in the range 10-20 MeV. Conclusions are drawn concerning the energy variations of the contributions of direct, pre-equilibrium and compound nucleus reactions. (author). 33 refs, 13 figs, 2 tabs.

21271 (IAEA-TECDOC—483, pp 224-235) **Progress in multi-step direct reaction theory.** Marcinkowski, A. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The current status of the multi-step direct theories and their application in evaluation of cross sections of nucleon induced reactions at energies between 11 and 62 MeV are reviewed. The interplay of the one-step process with respect to the multi-step processes are discussed. (author). 30 refs, 5 figs.

21272 (IAEA-TECDOC—483, pp 246-255) **Application of different pre-equilibrium models to the description of double differential neutron emission cross-sections - comparisons discussed for the case /sup 93/Nb+n.** Seeliger, D. (Technische Univ., Dresden (German Democratic Republic)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

During the past years a diversity of pre-equilibrium models and computer codes have been developed and used for the theoretical description of DONECS in the frame of neutron nuclear data evaluations. For the case /sup 93/Nb+n different approaches are discussed, briefly. The importance of consideration of direct collective excitations (besides the single-particle pre-equilibrium descriptions) in this case is outlined. A new SMD/SMC-approach presented at this meeting seems promising in this respect. The present paper has to be considered in conjunction with three contributed papers where some specific problems are discussed in more detail. (author). 19 refs, 9 figs.

21273 (IAEA-TECDOC—483, pp 269-273) **Semi-empirical description of double-differential neutron emission spectra.** Torjman, M.; Kalka, H.; Hermsdorf, D.; Seeliger, D. (Technische Univ., Dresden (German Democratic Republic)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A simple procedure of semi-empirical parametrization of the direct contributions in double-differential neutron emission cross sections is proposed. For the case /sup 93/Nb+n in the broad incidence energy range from 5 MeV to 26 MeV this model is proved. In addition to spectra calculations with the exciton model it provides a satisfactory description of the experimental behaviour in the full neutron incidence and emission energy range including angular distributions. (author). 24 refs, 6 figs.

21274 (IAEA-TECDOC—483, pp 273-277) **Statistical multistep direct and compound processes below 30 MeV for / sup 93/Nb.** Kalka, H.; Seeliger, D.; Zhivopistsev, F.A. (Technische Univ., Dresden (German Democratic Republic); Moskovskij Gosudarstvennyj Univ. (USSR)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A simple reaction model for statistical multistep direct (SMD) and multistep compound processes (SMC) including quasi-particle and phonon excitations is presented and tested on 93-Nb(n,n') and (n,p) at incidence energies between 5 and 26 MeV (author). 12 refs, 3 figs, 1 tab.

21275 (IAEA-TECDOC—483, pp 278-292) **Application of nuclear models to the calculation of 20-100 MeV neutron induced reaction data.** Arthur, E.D.; Bozoian, M.; Madland, D.G.; Perry, R.T.; Wilson, W.B.; Young, P.G. (Los Alamos National Lab., NM (USA)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

A variety of theoretical and empirical nuclear models have been applied (and in some cases developed) to the problem of the calculation of neutron reactions in the incident energy range from 20-100 MeV. These models are described with emphasis on their suitability for description of higher energy neutron reaction processes. Results obtained from these models are compared with available proton-and neutron-induced experimental data. Finally neutron data libraries developed via such methods are described. (author). 33 refs, 25 figs, 3 tabs.

21276 (IAEA-TECDOC—483, pp 293-296) **Quasi-free scattering approach to three body direct process and its application to nuclear data.** Zhang Benai; Sun Weili. (Institute of Applied Physics and Computational Mathematics, Beijing, BJ (China)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

This paper has studied three body break-up process. The wave function of the relative motion of collision particles is chosen to be plane wave. We obtained the angular-energy double differential cross section of each secondary particle, the differential cross section of two- particle correlation, and the integral cross section in the simple computational form. (author). 3 refs.

21277 (IAEA-TECDOC—483, pp 296-299) **DWBA calculations for the (n,p) reaction cross-sections.** Yu Ziqiang; Zuo Yixin. (Nankai Univ., TJ (China). Dept. of Physics; Nankai Univ., TJ (China). Dept. of Mathematics). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Direct (n,p) cross sections for the Na, Mg, Al and Si target nuclei have been calculated by using DWBA in the zero-range approximation and added to the results obtained by the statistic theory. The n-p effective interaction strength which vary linearly with the incident neutron energy are determined by comparisons with experimental data. (author). 4 refs, 4 figs.

21278 (IAEA-TECDOC—483, pp 303-305) **Systematics of isomer ratios for neutron induced activation reactions at 14.5 MeV.** Gruppelaar, H.; Kopecky, J. (Netherlands Energy Research Foundation, Petten). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The present status of the knowledge on branching ratios of the isomeric and ground-state cross-sections at 14 to 15 MeV is reviewed. Earlier systematics for the isomer ratios of the (n,n'), (n,p), (n,t), (n,α) and (n,2n) reactions are examined and new systematics for these reactions are presented. A comparison with model calculation is discussed. The (n,2n) isomer ratios show a behaviour different from that of the studied binary reactions. (author). 8 refs, 2 figs.

21279 (IAEA-TECDOC—483, pp 309-310) **Intercomparison of nuclear model computer codes.** Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

The present state of the programme of intercomparison of nuclear model computer codes, organised under the auspices of the NEA Data Bank in Paris, is reviewed. The different types of intercomparison are described, and the general principles underlying the intercomparisons are critically discussed. (author). 4 refs, 1 tab.

21280 (IAEA-TECDOC—483, pp 134-137) **Theoretical methods for the calculation of fast neutron fission cross-sections.** Ohsawa, T. (Kyushu Univ., Fukuoka (Japan). Dept. of Nuclear Engineering). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Methods of fission cross section calculation are reviewed and discussed. There are two methods. The first is utilization of systematics and empirical data. This itself comprises two methods. One is application of systematics observed in fission cross section values in the MeV-region. Another is the use of fission probability data obtained from direct reactions such as (d,pf),(t,pf) in order to produce simulated neutron-induced fission cross sections. The second method is theoreticai model calculation based on the double-humped barrier concept of fission. In this report, the results of our analysis of fission cross sections for 24 actinide nuclides ranging from protactinium to californium are discussed. An attempt has been made to deduce the surface energy coefficient of liquid drop model from the fission barrier heights obtained in the present analysis. (author). 27 refs, 10 figs, 2 tabs.

21281 (IAEA-TECDOC—483, pp 148-160) **Theoretical models and computer programs for the calculation of prompt fission neutron spectra.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic)). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Prompt fission neutron emission has to be understood as a superposition of different mechanisms connected with the dynamics of fission directly (scission neutron emission) or indirectly (evaporation from a fragment diversity). The general requirements to be met in calculating emission probabilities of prompt fission neutrons in the framework of a complex statistical-model approach (SMA) assuming evaporation from fully accelerated fragments (predominant mechanism of post-fission neutron emission) as well as recent approaches and computer codes are summarized. It is shown that experimental multiple-differential emission probabilities of 252-Cf(sf) neutrons (specifically the energy spectrum as a nuclear standard) can be well reproduced by the use of a special SMA - the complex cascade evaporation model (CEM). Several global parametrizations of the optical potential for the calculation of the inverse cross sections of compound-nucleus formation have been tested. The application of a complex SMA to any fission reaction has to be based on the theoretical or semi-empirical description of the fragment data needed (distribution in nucleon numbers, kinetic energy, excitation energy, angular momentum; fragment angular distribution). The present status is briefly discussed. In the case of multiple-chance fission reactions, the SMA to post-fission neutron emission has to be connected with nuclear reaction theory including the calculation of the partial fission cross sections as well as of the spectra of pre-fission neutrons. The theoretical scheme for the adequate and consistent description of scattered-neutron cross sections, fission cross sec-

tions, fragment data, and post-fission neutron data is formulated and discussed. (Abstract Truncated)

21282 (IAEA-TECDOC—483, pp 160-164) **Watt spectrum fit to /sup 252/Cf prompt fission neutron data.** Froehner, F.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Nov 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88705972/JAW. (CONF-8710181—).

From International Atomic Energy Agency advisory group meeting on nuclear theory for fast neutron nuclear data evaluation; Beijing, China (12 Oct 1987).

Recent measurements of the /sup 252/Cf prompt fission neutron spectrum have been fitted with four types of theoretical models: (1) a Maxwell spectrum, (2) a Watt spectrum, (3) a superposition of two Watt spectra representing a typical fission fragment pair, and (4) a relativistic generalisation of (3). Instrumental resolution has been accounted for by exploitation of the fact that the Watt spectrum and the free-gas Doppler broadening kernel are mathematically identical. The Maxwell spectrum is inadequate, as expected, but a Watt spectrum with T/sub W/=1.18 MeV and E/sub W/=0.36 MeV fits all data well, except for those above 17 MeV from one set, with a chi-square that indicates no need for a more refined model. The superposition of two Watt spectra and the relativistic generalisation do not improve the fit. (author). 19 refs, 3 figs.

21283 **(IC—88/364) Relativistic ground state energy of the Λ particle in hypernuclei using Woods-Saxon potentials.** Koutroulos, C.G. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705994/JAW.

The relativistic Dirac equation with scalar potential and fourth component of vector potential of the Woods-Saxon shape is considered with the aim of determining the parameters of the potentials and the ground state binding energies of the Λ particle in hypernuclei. (author). 15 refs, 3 tabs.

21284 **(ICEFIZ-FT—324-1988) Spontaneous pion emission as a new natural radioactivity. Dynamical predictions.** Ion, D.B.; Ivascu, M.; Ion-Mihai, R. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania); Bucharest Univ. (Romania)). (Central Inst. of Physics, Bucharest (Romania)). Jan 1988. 39p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706004/JAW.

A theoretical model based on the assumption that the spontaneous pion emission from the ground state of a nucleus can be described as a fission like process is proposed. Then, the nuclear instability with respect to the spontaneous pion emission is discussed in terms of the π/sup -/ fissionability parameter. Analytical results for the π - fission barrier and the spontaneous π - fission half-lives are derived from those of the usual fission using the substitution: x -> xsub(πF), Z/sup 2//A -> (Z/sup 2//A)sub(πF). Absolute predictions for GAMMA sub(π)/GAMMAsub(SF) are presented. (authors).

21285 **(ICEFIZ-FT—330-1988) HRPA treatment of the collective magnetic state 1/sup +/.** Raduta, A.A.; Ursu, I.I.; Faessler, A. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania); Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). (Central Inst. of Physics, Bucharest (Romania)). Mar 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706007/JAW.

A system of (Z,N) nucleons moving in an anisotropic oscillator potential and interacting among themselves through an isoscalar plus an isovector q/sub 2/q/sub 2/ interaction is treated within a boson expansion technique. (authors).

21286 **(ICEFIZ-FT—332-1988) Predictions for pionic nuclear radioactivity from fission data of even-even nuclei.** Ion, D.B.; Ivascu, M.; Ion-Mihai, R. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania); Bucharest Univ. (Romania)). (Central Inst. of Physics, Bucharest (Romania)). May 1988. 16p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706008/JAW.

The nuclear instability with respect to the spontaneous pion emission from the nuclear ground state is discussed in terms of a fission-like model. Then, analytical results as well as numerical predictions for some even-even π-emitters are obtained from the spontaneous fission half-lives by the substitution (Z/sup 2//A)-> (Z/sup 2//A)sub(π). These results are extended and compared with the yields of the light charged particle emission during fission. (authors).

21287 **(ICEFIZ-NP—58-1987) Search for spontaneous pion emission in /sup 252/Cf.** Bucurescu, D.; Brehui, M.; Ion, D.B.; Petrascu, M.; Topor, V.; Haiduc, M.; Ion-Mihai, R.; Petrascu, C.; Tolstov, K. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania); Centrul de Astronomie si Stiinte Spatiale, Cluj (Romania); Bucharest Univ. (Romania); Joint Inst. for Nuclear Research, Dubna (USSR)). (Central Inst. of Physics, Bucharest (Romania)). Apr 1987. 4p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706015/JAW.

Nuclear emulsions were irradiated in the presence of a /sup 252/Cf source at a total spontaneous fission number of 9.66 10/sup 6/. Upper limits for pion emission in the range 10/sup -7/, depending on the pion energy were derived. (authors).

21288 **(ICEFIZ-NP—60-1987) Atomic nucleus - a foam of anti de Sitter microuniverses.** Rosu, H. (Centrul de astronomie si stiinte spatiale, Bucuresti, Romania). (Central Inst. of Physics, Bucharest (Romania)). May 1987. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706017/JAW.

The route to a cosmological model of the atomic nucleus displays very attractive features.

21289 **(IFIN-FT—326-1988) Semiclassical treatment of the ground state rotational band and of the isovector angle vibration for deformed superfluid nuclei.** Grigorescu, M. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Feb 1988. 24p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706043/JAW.

The definition of the pairing interaction for rotating systems is discussed, and a simple, mainly analytic model for its treatment is formulated. The results are used to describe microscopically the giant angle dipole resonance of the superfluid deformed nuclei, in the semiclassical approximation of the cranking model.

21290 **(INDC(BZL)—28) Intercomparison of derived integral data from evaluated data libraries of the actinides.** Paviotti Corcuera, R.; Trkov, A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados; Institut Jozef Stefan, Ljubljana (Yugoslavia)). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Dec 1988. 59p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705490/JAW.

Resonance integrals and fission spectrum averaged cross-sections are calculated for the actinides from all recent major evaluated libraries. Whenever possible the results are compared against measurements. It is found that the experimental data are scarce and that there exist considerable differences between experimentally measured data and those derived from the evaluated libraries. (author). 93 refs and tabs.

21291 (INDC(YUG)—11) **Comparison of evaluations for /sup 235/U, /sup 239/Pu, /sup 240/Pu, /sup 241/Pu and /sup 242/Pu with integral measurements.** Trkov, A. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Aug 1988. 77p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705496/JAW.

The evaluations for /sup 235/U, /sup 239/Pu, /sup 240/Pu, /sup 241/Pu and /sup 242/Pu are considered. Intercomparison is made of the neutron cross section data from INDL/A, ENDL-84, ENDF/B-5 and ENDF/B-6 (where applicable). Integral measurements of the spectrum averaged cross sections are compared to the values derived from evaluated data libraries. (author). 40 refs, 49 figs, 11 tabs.

21292 (INIS-mf—11358, pp 47) **Photodisintegration of the deuteron at Eγ= 2,75 MeV.** Smit, F.D.; Brooks, F.D. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria; Cape Town Univ. (South Africa). Dept. of Physics). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21293 (INIS-mf—11358, pp 49) **Study of the /sup 90/Zr(n,d)/sup 89/Y reaction.** Bawa, A.C.; Bharuth-Ram, K.; McMurray, W.R. (Durban-Westville Univ. (South Africa); Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21294 (INIS-SU—70, pp 21-23) **Estimation of resonance parameters of Δ/sub 33/ isobar on the base of data on the π/sup 0/ meson photoproduction on /sup 12/C nucleus.** Belousov, A.S.; Vazdik, Ya.A.; Malinovskij, E.I.; Smirnov, P.A.; Solov'ev, Yu.V.; Rusakov, S.V.; Terkulov, A.R.; Usik, A.P.; Fomeko, A.M. 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

Resonance parameters of Δ/sub 33/ isobar are estimated on the basis of the data on differential cross sections of π/sup 0/ meson production on /sup 12/C nucleus in the 300-450 MeV energy range at the angle of escape of about 8.8 deg in the centre-of-mass system. It is found out that the resonance width decreases due to interaction of Δ isobar with the nucleus. 14 refs.; 1 fig.

21295 (ISN—87-91) **Results of the naive quark model.** Gignoux, C. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Oct 1987. 13p. (In French). (CONF-8706251—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757022/JAW.

From Workshop on intermediate energies; Grenoble, France (3 Jun 1987).

The hypotheses and limits of the naive quark model are recalled and results on nucleon-nucleon scattering and possible multiquark states are presented. Results show that with this model, ropers do not come. For hadron-hadron interactions, the model predicts Van der Waals forces that the resonance group method does not allow. Known many-body forces are not found in the model. The lack of mesons shows up in the absence of a far reaching force. However, the model does have strengths. It is free from spuriousness of center of mass, and allows a democratic handling of flavor. It has few parameters, and its predictions are very good.

21296 (KURRI-TR—303, pp 15-19) **Measurements of nuclear polarization and nuclear magnetic moment of /sup 170/Tm in /sup 170/Tm:SrF/sub 2/ by optical pumping.** Shimomura, K. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research). May 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89003364/JAW. (CONF-8801127—).

From 4. specialist research meeting on measurements of short-lived isotopes; Kyoto, Japan (12 Jan 1988).

Significant nuclear polarization of unstable /sup 170/Tm in Tm/sup 2+/:SrF/sub 2/ was for the first time achieved with β-ray radiation detected optical pumping in solids, providing a new powerful method to measure magnetic moments of unstable nuclei.

21297 (LBL—26225) **Structure studies of low-lying O/sup plus/ states in the deformed rare-earth region.** Shihab-Eldin, A.A.; Rasmussen, J.O.; Stoyer, M. (Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098. 19p. (CONF-881054—47). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006649/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

To better understand the structure of the low lying O^+ states of even-even nuclides in the deformed rare-earth region, we have carried out calculations to generate the wavefunctions, energies and pair transfer rates from/to these states within a framework of exact diagonalization of the residual pairing and n-p forces. First we carried out exact diagonalization for the neutron and proton systems separately, using as a basis space the 126 vector space of four/five pairs within nine appropriate deformed Nilsson orbitals. For the pairing force we included both monopole and quadrupole terms. Next, we used the lowest eight eigenfunctions from both the neutron and the proton systems to generate a new basis space composed of the 64 possible neutron-proton product vectors. The n-p force was approximated by a quadrupole-quadrupole force term which was then diagonalized within the new basis space. The resulting wave functions were used to calculate the neutron pair transfer strength from and to the various low O^+ states below 3 MeV in the even-even Gd, Dy and Er isotopes. Furthermore, for the case where the deformation parameters do not change appreciably between the pair of nuclides involved in the pair transfer reaction, reasonable global agreement was obtained for the measured (t,p) and (p,t) pair transfer reaction strengths both to the ground and excited states O^+ states accessible in these isotopes. The observed enhancement of (t,p) pair transfer strength to excited states in some of these isotopes was reproduced by the calculation. The enhancement is due to subshell gap and large relative pair transfer amplitude for an orbital near the Fermi surface. 24 refs., 7 figs.

21298 (UCID—21659) **Cross sections for (p,n) and (d,2n) reactions on ^{79}Br and ^{127}I: An evaluation of literature and model calculated results.** Lanier, R.G.; Mustafa, M.G.; West, H.I. Jr. (Lawrence Livermore National Lab., CA (USA)). 1 Feb 1989. Contract W-7405-ENG-48. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008644/JAW.

We have evaluated (p,n) and (d,2n) cross sections on ^{79}Br and ^{127}I, and made these cross sections available for test diagnostics. We believe that these interim cross sections are of reasonable accuracy and should be used for diagnostic interpretations until more precise measurements can be made. Our evaluation consisted of a literature search and an examination of the available experimental data. These data were supplemented by statistical model calculations using both the STAPRE and ALICE codes. We found reasonably good measured data (from threshold to the peak of the excitation function) for the (p,n) reaction on both ^{79}Br and ^{127}I. The literature data for the (d,2n) reaction on ^{127}I are questionable and no data were found for the (d,2n) reaction on ^{79}Br. We have, therefore, relied completely on calculations for the (d,2n) cross sections for both ^{79}Br and ^{127}I. 4 figs., 5 tabs.

21299 **(X-EP-LPNHE-RA—1986) Progress report 1986. Laboratory of high energy nuclear physics.** (Ecole Polytechnique, 91 - Palaiseau (France). Lab. de Physique Nucleaire et des Hautes Energies). 1987. 43p. (In French). (LPNHEEX-RA—1986). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757033/JAW.

A study of hadron structure using neutrino interactions; high energy photon interactions; a search for gluinos; a spectrometer for the study of quark fusion and structure functions; measurement of the real part of the pp/sup -/ scattering amplitude at 546 GeV; measurement of photon production in the fragmentation region of pp/sup -/ interactions at 630 GeV; investigation of very high energy nucleus-nucleus interactions: the quagma; an experience on nucleon stability; as well as high energy nuclear physics research facilities are described.

21300 **Interferometry of the compound nucleus.** Koonin, S.E.; Bauer, W.; Schaefer, A. (W.K. Kellogg Radiation Laboratory, California Institute of Technology, Pasadena, California 91125 and National Superconducting Cyclotron Laboratory and Physics Department, Michigan State University, East Lansing, Michigan 48824). *Physical Review Letters;* **62**: No. 11, 1247-1250(13 Mar 1989).

We consider interference effects in the inclusive emission of two identical particles from a compound nucleus. Statistical assumptions result in a correlation of the emitted particles that depends upon the coherence properties of the level widths in a form similar to that describing fluctuations in an exclusive cross section. A schematic application to the decay of a rapidly rotating compound nucleus shows that the observed source size can depend upon the kinematics of the measurement.

21301 **Comparison of mean-field and exact Monte Carlo solutions of a one-dimensional nuclear model.** Alexandrou, C.; Myczkowski, J.; Negele, J.W. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 1076-1087(Mar 1989).

The ground states of nuclear matter and finite nuclei are calculated for a one-dimensional model having a two-body potential with strong short-range repulsion and long-range attraction. Mean-field theory with a phenomenological density-dependent interaction is shown to yield a good approximation to the exact binding energies and density distributions when appropriate center-of-mass corrections are applied. This model thus provides a framework for quantitative study of corrections to mean-field theory.

21302 **Structure of /sup 17/C and /sup 17/N.** Warburton, E.K.; Millener, D.J. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 1120-1129(Mar 1989).

The energy spectra and wave functions of /sup 17/C and /sup 17/N are calculated using a modification of the Millener-Kurath interaction. The results are used to predict the half-life and decay modes of both the allowed and first-forbidden β^- decays of /sup 17/C as well as /sup 18/O(d,^{3}He)/sup 17/N spectroscopic factors and electromagnetic transition rates in /sup 17/N.

21303 **Finite-density effective sigma meson mass in chiral models.** Griegel, D.K.; Cohen, T.D. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 1032-1038(Mar 1989).

Properties of chirally-invariant models of nuclear matter are calculated with the relativistic Hartree approximation. Our emphasis is on the behavior of the effective σ meson mass. We find that the effective σ mass does not scale with the effective nucleon mass, which in these calculations is proportional to the expectation value of the σ field, i.e., the chiral order parameter. These results suggest that a decrease in the effective σ mass with increasing nucleon density is not a generic feature of chiral models. We also find that the incompressibility of nuclear matter is lower for those models with higher effective σ masses.

21304 **Phenomenological analysis of dispersion corrections for neutron and proton scattering from /sup 208/Pb.** Finlay, R.W.; Wierzbicki, J.; Das, R.K.; Dietrich, F.S. (Ohio University, Athens, Ohio 45701). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 804-817(Mar 1989).

Elastic scattering of protons and neutrons from /sup 208/Pb in the energy range up to 61.4 MeV is analyzed in order to establish a consistent phenomenology with which to examine the recent results of dispersion theory. The present analysis avoids conventional assumptions about the energy dependences of potential depths or geometrical parameters and attempts to include estimates of the uncertainty in our knowledge of the derived potential parameters. Recently reported evidence for energy-dependent geometrical parameters in the n+/sup 208/Pb potential is supported by the present analysis, but no comparable effect is observed for phenomenological proton potentials in the range of available data (E/sub p/ >9 MeV). The present analysis shows that, unlike the situation for heavy-ion scattering, the Coulomb potential does not cut off the imaginary potential for p+/sup 208/Pb. Consequently, no rapid excursions in the parameters of the p+/sup 208/Pb potential are expected to occur until the incident energy is well below the Coulomb barrier where the nuclear potential is essentially unobservable.

21305 **Peripheral reactions induced by a 2.1-GeV/nucleon /sup 12/C beam on a C target using a simple combinatorial model.** Cole, A.J.; Lindstrom, P.J.; Crawford, H.J.; Harvey, B.G. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 891-896(Mar 1989).

Recently acquired data on peripheral reactions induced by a /sup 12/C beam at 2.1 GeV/nucleon on a C target have been used to create a distribution of exclusive yields ("mass patterns") in which the charge of detected fragments is ignored and the data supplemented by (presumed) missing nucleons. A simple multinomial expression using probabilities obtained from inclusive mass yields gives a satisfactory account of the revised data.

21306 **Kaon photoproduction from nuclei in a relativistic nuclear model.** Bennhold, C.; Wright, L.E. (Department of Physics and Astronomy, Ohio University, Athens, Ohio 45701). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 3, 927-941(Mar 1989).

The formation of hypernuclei through the photoproduction of kaons is formulated in the framework of a relativistic distorted wave impulse approximation. The basic production operator is based on diagrammatic techniques and includes low-lying baryon and meson resonances. Relativistic single-particle wave functions obtained by solving the Dirac equation with scalar and timelike vector potentials are employed to describe the nucleon and hyperon bound states. The nuclear and hypernuclear structure is described in a pure single-particle single-hole model. Evaluating the matrix elements in momentum space allows straightforward treatment of Fermi motion and naturally includes nonlocalities arising from the production operator. Different nonrelativistic limits involving the upper and lower component of the Dirac wave function and a p/M expansion of the operator are investigated. The final-state interaction of the weakly absorbed kaon is incorporated via an optical potential. A variety of angular distributions for p-shell nuclei is presented and the sensitivity of the hypernuclear cross sections to the elementary operator is shown to be important. Relativistic effects are found to be important along with effects of nonlocalities for low-spin states while high-spin states with large cross sections are less affected. Kaon distortion for p-shell nuclei only provides a slight reduction in cross section for most transitions.

21307 **Corrections to the Fermi matrix element for superallowed β decay.** Ormand, W.E.; Brown, B.A. (The Niels Bohr Institute and NORDITA, University of Copenhagen, Blegdamsvej 17, DK-2100 Copenhagen OX, Denmark). *Physical Review Letters;* **62**: No. 8, 866-869(20 Feb 1989).

Corrections to the Fermi matrix element for superallowed transitions due to isospin nonconservation are reexamined. The sources of theoretical uncertainty and the possibility of a previously

neglected correction based on the mismatch between the spectator nucleons are investigated. The consequences to the conserved-vector-current hypothesis and the Kobayashi-Maskawa mixing angles are discussed.

21308 **Calculated differential secondary-particle production cross sections after nonelastic neutron interactions with carbon and oxygen between 15 and 60 MeV.** Brenner, D.J.; Prael, R.E. (Radiological Research Laboratories, College of Physicians & Surgeons of Columbia University 630 West 168 Street, New York, New York 10032). *Atomic Data and Nuclear Data Tables;* **41**: No. 1, 71-130(Jan 1989).

Calculated values are given for double-differential (energy/angle) cross sections for the nonelastic production of hydrogen and helium isotopes and heavier-mass recoils, after the interaction of 15- to 60-MeV neutrons with carbon and oxygen. The data are calculated with an intranuclear cascade code, including alpha clustering and particle pickup, followed by a Fermi-breakup mechanism, incorporating decay via intermediate particle-unstable states. The predictions have been extensively tested against available experimental data in this energy/mass range. copyright 1989 Academic Press, Inc.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 20725, 20740, 20979

21309 **(CTA-IEAV-NT—018/86) Process of cross section generation for radiation shielding calculations, using the NJOY code.** Ono, S.; Corcuera, R.P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Oct 1986. 31p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705425/JAW.

The process of multigroup cross sections generation for radiation shielding calculations, using the NJOY code, is explained. Photon production cross sections, processed by the GROUPR module, and photon interaction cross sections processed by the GAMINR are given. These data are compared with the data produced by the AMPX system and published data.

21310 (INIS-BR—1424, pp 28) **QED in crystalline media: the Cerenkov emission of X-rays.** Caticha, A. (Universidade Estadual de Campinas, SP (Brazil)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21311 **(IPNO-DRE—88-20) Projected study of neutronic decay of giant resonances and continuum states.** Blumenfeld, Y.; Chomaz, P.; Fortier, S.; Frascaria, N.; Gales, S.; Guillot, J.; Langevin, H.; Laurent, H.; Maison, J.M.; Nguyen Van Giai and others. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1988. 25p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757208/JAW.

A project to study the decay of very excited states in nuclei is presented. A multidetector to measure these modes for excited structures situated beyond the neutron emission threshold is proposed. Coincidence experiments would allow a study of the wave functions of these elementary excitations and of the damping mechanisms in the nuclear domain. The definition of the characteristics of the system; tests to be carried out before selecting a detector; and nonscientific and nontechnical aspects of the project are also presented.

21312 **(JAERI-M—88-198) Interpolation of gamma-ray buildup factors in atomic number, using the geometrical progression (G-P) parameters.** Sakamoto, Yukio; Tanaka, Shunichi; Harima, Yoshiko. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 79p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756915/JAW.

The values of buildup factors for specified energy above K-edges and penetration distance vary smoothly with respect to atomic number, and the geometrical progression (G-P) parameters behave also similarly. An interpolation of buildup factors for an arbitrary elemental material was examined using the G-P parameters for an equivalent atomic number, where the G-P parameters are data fitted to the proposed American National Standard buildup factor data compilation of 17 elements from Be to Mo calculated by the moments method and those for 8 elements of Fe, Mo, Sn, La, Gd, W, Pb and U, including bremsstrahlung and fluorescence, calculated by the PALLAS code. It has been confirmed through various tests over a wide range of atomic number that the values of the buildup factors generated by interpolated G-P parameters can accurately reproduce the basic data calculated directly over the full range of energy within a few percent. The values of equivalent atomic number for mixture materials, such as water, air, concrete and lead glass of the density 4.36, are determined from a ratio of scattering cross section to the total attenuation coefficient. The buildup factors for these materials calculated using the G-P parameters, interpolated by the equivalent atomic number, are in good agreement with the basic data, except the buildup factors for lead glass to γ-ray energy above 3 MeV.

21313 **(LA-UR—89-495) Introduction to maximum entropy.** Sivia, D.S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-8810182—18). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007983/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

The maximum entropy (MaxEnt) principle has been successfully used in image reconstruction in a wide variety of fields. We review the need for such methods in data analysis and show, by use of a very simple example, why MaxEnt is to be preferred over other regularizing functions. This leads to a more general interpretation of the MaxEnt method, and its use is illustrated with several different examples. Practical difficulties with non-linear problems still remain, this being highlighted by the notorious phase problem in crystallography. We conclude with an example from neutron scattering, using data from a filter difference spectrometer to contrast MaxEnt with a conventional deconvolution. 12 refs., 8 figs., 1 tab.

21314 **Relation between half-width of neutron spectra and transport properties of fluids.** van Loef, J.J.; Cohen, E.G.D. (Interfacultair Reactor Instituut, University of Technology, 2629 JB Delft, The Netherlands). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4715-4715(1 Mar 1989).

A simple connection is made between the minimum half-width of neutron spectra and the transport properties of a number of noble-gas fluids.

6550 Medical Physics

REFER ALSO TO CITATION(S) 20442, 20442, 20584, 20734, 20736

21315 **(AERE-R—13291) Preparation and measurement of /sup 241/Am solutions to establish traceability of counting equipment to the National Physical Laboratory.** King, M.; Wiltshire, R.A.P. (UKAEA Harwell Lab. Chemistry Div.). Oct 1988. 8p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705956/JAW.

Measurement of the /sup 241/Am activity in ampoules prepared from a stock solution has established direct traceability of the Harwell low geometry counters numbers 12 and 13 to the 4π alpha/gamma coincidence counting equipment at the National

Physical Laboratory. The mean values obtained from measurements on three ampoules at each establishment agree to within 0.2%; the difference lies within the respective experimental errors.

21316 **(CEA-tr—2315) TDCR Calibration method of a radioactive source activity for liquid scintillation counting.** Lan Yunxia; Li Mingrao. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1988. 15p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756997/JAW.

A new method for the calibration of a radioactive source for liquid scintillator counting is described. The method uses, as yield variation parameter, the triple and double coincidence ratio (TDCR), the coincidence counting ratio curve is extrapolated up to TDCR = 1 and an approximate value of the sample activity is obtained directly. The paper gives the principle of the method, yield calculation and an estimate of theoretical uncertainty. Measurements for tritiated water agree with total uncertainty of +- 0.63 % of the NBS standard value.

21317 **(DOE/ER/60707—1) [Considerations of beta and electron transport in internal dose calculations]: [Progress report].** Poston, J.W. (Texas A and M Univ., College Station (USA). Research Foundation). [1989]. Contract FG05-88ER60707. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008085/JAW.

This task involved use of the code INDOSE-EGS for calculation of S-values for radionuclides of importance in nuclear medicine. This task was proposed to proceed in a logical fashion as outlined below: identification of radionuclides for which more refined dose estimates are required; identification of the target and source combinations for which the previous assumption is clearly invalid; production of a base of data for monoenergetic radiations with sufficient accuracy to be used in dose calculations; calculation of revised dose estimates, i.e., S-values. The extension of this code to include head and neck models, gall bladder models, and kidney models are discussed. 2 refs.

21318 **(EUR—11689) Certification of a nickel metal reference material for neutron dosimetry (EC Nuclear Reference Material 521).** Pauwels, J. (Commission of the European Communities, Geel (BE). Central Bureau for Nuclear Measurements). (Commission of the European Communities, Luxembourg). 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757199/JAW.

Nickel metal, of 99.99 % nominal purity and natural isotopic composition, in the form of 0.1 mm thick foil and 0.5 mm diameter wire has been certified for its cobalt mass fraction. The certified value of cobalt ($<0.1 \mu g.g^{-1}$) is based on 38 results obtained by neutron activation analysis, emission spectrometry with inductively coupled plasma excitation and atomic absorption spectrometry, whereas the isotopic composition of the nickel was verified by thermal ionization mass spectrometry. The material is intended to be used as a reference material in neutron metrology.

21319 **(IC—88/295) Exposures of the postulated accident estimated using the propeller and supersonic wind data.** Hu, Shze Jer; Katagiri, Hiroshi; Kobayashi, Hideo. (International Centre for Theoretical Physics, Trieste (Italy); Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 22p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705981/JAW.

One year meteorological wind data obtained in 1987 by the propeller and supersonic anemometers were used to calculate the adult thyroid exposure doses and external γ whole body exposures for a postulated accident with one hour effective release time. The results show that the adult thyroid exposure dose is sufficiently accurate and valid when estimated basing on the contributions of individual iodine nuclides without considering their decay and using the supersonic wind data without modifying the assumed mean wind speed of the calm. For the external γ whole body exposure, a more accurate and realistic estimation should base on the contributions of individual radionuclides with their decay considered and use the supersonic wind data for atmospheric dispersion analysis. (author). 4 refs, 9 tabs.

21320 (INIS-BR—1411, pp 253-259) **New guidelines for dose calculations in the Federal Republic of Germany.** Narrog, J. (Ministerium fuer Unwelt Baden - Wuerttemberg, Stuttgart (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The German guideline for dose calculations under normal conditions, the so-called "Allgemeine Berechnungsgrundlage" is under revision. There are several changes in detail, corresponding to the advanced stage of radioecological science. A review on the most important changes and the basically considerations is given.

21321 (INIS-BR—1411, pp 295-304) **Overview on radiation protection in a monazite plant - Nuclemon.** Ricco, H.M.M.V. (NUCLEMON, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The paper presents the application of the general principles and the radiation protection standards by means of the Radiation Protection and Environmental Monitoring Programs, in the units of ore concentration and chemical treatment of monazite - a rare earth mineral containing about 6 per cent ThO/sub 2/ and 0,2 per cent U/sub 3/O/sub 8/. The NUCLEMON industrial installations - Usina de Praia and Usina Santo Amaro - have been operating for about forty years. The operational changes executed in various areas intending to decrease the doses of radiation are here approached.

21322 **(INIS-BR—1411) Proceedings of the Seminar on Radiation Protection and Environmental Control.** (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. 351p. (In Portuguese). (CONF-8808196—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW.

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Some papers about radiation protection and environmental control for nuclear installations in Brazil and Federal Republic of Germany are presented. (E.G.).

21323 (INIS-BR—1411, pp 30-40) **Environmental control and radioprotection in Itataia and Lagoa Real uranium mines.** Cenachi, N.C. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Monitoring Programs in Itataia and Lagoa Real uranium mines were initiated in 1982. In the actual pre-operational phase of this Programs, are being collected samples of air, surface and underground waters, stream sediments, soil, field products, and milk. Environmental contamination of air is controlled by thermoluminescent dosimeters, distributed around the mines. Instantaneous radiation measures in this stations are made with scintillometer calibrated in Radioprotection Laboratory Department-CDTN. Photographic dosimeters are used for monitoring external radiation exposures in workers. Radiation levels evaluation, air and surface contamination measures, were effectuated in installations, trenches, and research galleries. Another factors which are now being studied: climate, meteorology, and hidrology.

21324 (INIS-BR—1411, pp 41-50) **Concepts for individual dosimetry.** David, J. (Institut fuer Strahlenschutz, Stohl (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

Following the "German guidelines for the physical monitoring in radiation protection of occupationally exposed personnel" this concept is shown. Because of the unmeasurability of the dose

equivalent resp. the effective dose equivalent the estimation of these quantities is based on operational quantities. They are given by the properties of the radiation source, the field quantities, the ambient dose or the individual dose equivalent. Confining to the external radiation different types of dose equivalent determinations are described: If an operational quantity is below an investigation level the dose equivalent is equated with the operational dose quantity. If one assumes that dose equivalent limits might have been exceeded conversion factors are taken into account. If accidental exposures are found a determination of absorbed dose distribution with sophisticated exposure models is used (ICRP 28). The present discussion about the properties of the new operational quantities in ICRU 39 is described.

21325 (INIS-BR—1411, pp 51-60) **Individual dosimetry technics.** David, J. (Institut fuer Strahlenschutz, Stohl (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

This paper gives a list of different personal monitoring systems to determine dose quantities in radiation protection. Two types of dosemeters are required: are dosemeters and personal dosemeters. Confining to the personal dosemeters, which are constructed to be worn on the body, they fall into two classes: Dosemeters for record purpose and dosemeters showing directly changes of radiation fields, for example alarm dosemeters. In each class there are dosemeters for photons, electrons and neutrons. The systems used in Germany are reported.

21326 (INIS-BR—1411, pp 102-113) **Determination of the Activity Median Aerodynamic Diameter (AMAD) and the Mass Median Aerodynamic Diameter (MMAD) at the USAM/NUCLEMDN facilities.** Ferreira, E.G. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The work described in this paper was performed in order to determine the Median Aerodynamic Diameter of particulates, in terms of activity (AMAD) and mass (MMAD) at the facilities of the Physical Treatment of Monazite (TFM) and Chemical Treatment of Monazite (TQM), at Sto Amaro Plant, NUCLEMON, S. Paulo, during a typical working journey. At the relatively more radioactive areas, particles with aerodynamic diameters larger than 5μm predominate. Values obtained at TQM are: AMAD=8.5μm and MMAD = 9.2μm, close to the nonbreathable fraction; at TFM the values are equal to 5.2μm, for both AMAD and MMAD.

21327 (INIS-BR—1411, pp 149-154) **Environmental control at the Nuclebras fuel cycle facilities at Rezende.** Hunt, J.G. (NUCLEI, Rio de Janeiro, RJ (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

This paper discusses environmental control measures taken in the area of the fuel element facility and the uranium isotope enrichment plant build at the "Centro Industrial de Resende" (CIR). The objectives of the environmental control programe, the techniques used or being implanted, and the future work programs are described. Attention is called to foresseing environmental monitoring procedures under emergency conditions.

21328 (INIS-BR—1411, pp 155-165) **Radiation protection measures involving the goiania accident patients.** Hunt, J.G.; Rabello, P.N.P. (NUCLEI, Rio de Janeiro, RJ (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The radiological protection measures taken in the General Hospital of Goiania (HGG/INAMPS), due to the accident involving cesium 137 are described; the work of the NUCLEI personnel in the areas of: radiological protection of the medical and auxiliary staff, contamination control of the ward, radiological monitoring of the patients, waste management, personnel and area decontamination and patient transportation, is also described.

21329 (INIS-BR—1411, pp 260-270) **Recent developments of the environmental surveillance in the Federal Republic of Germany.** Narrog, J. (Ministerium fuer Unwelt Baden - Wuerttemberg, Suttagart (Germany, F.R.)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

A system of measurements of the radioactivity was introduced in the late fiftieth and early sixtieth in the territory of the FRG in order to control the impact of the fallout of nuclear weapon tests of the northern hemisphere. Due to the ban of atmospheric nuclear weapon tests by the USA and the SU and the decreasing importance of the remaining radioactive fallout this system played a small role in the early 80/sup th/. As a consequence of the Chernobyl-accident this system gained new importance. It was improved and amplified. Conceptes of nets of mesasuring stations were created and are now under construction. The system as a whole is determined both for normal and alert conditions.

21330 (INIS-BR—1411, pp 271-284) **Procedure for the estimation of effective equivalent dose due to chi and γ external radiation.** Pereira, E.G.; Pereira, M.T. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The External Individual Dosimetry Service of the Nuclear Technology Development Center in charge of the surveillance of about 3500 workers in several Institutions mainly Hospitals and Industries as well as its own people which work in uranium and monazite extraction and also those engaged in research work. This paper deals with the calculation procedures of the effective equivalent dose to be applied when the dose estimation is higher that the register level 5 mSv/year recomended by the International Comission on Radiological Protection.

21331 **(INIS-BR—1418) Radiation protection program of Petrobras in industrial radiography area.** Signorini, M. (PETROBRAS, Rio de Janeiro, RJ (Brazil)). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 7p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705741/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

Industrial hygiene has as main purpose the preservation of employees physical well being when exposed to certain agressive agents. PETROBRAS Industrial hygiene program forecasts preventive policies in several specific fields. For the ionizing radiations area it was developed the "Radiologic Protection Program" which also deals with specific actions in industrial radiography jobs. These actions are hereinafter presented. (C.M.).

21332 **(INIS-BR—1419) Implantation of inspection and radiation protection plan.** Cunha, J.L.R. da. (PETROBRAS, Rio de Janeiro, RJ (Brazil)). (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo, SP). 1988. 11p. (In Portuguese). (CONF-8804248—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705742/JAW.

From 1. Brazilian meeting of supervisors in industrial radioprotection; Sao Paulo, Brazil (11 Apr 1988).

Methods, means and procedures adopted by Petrobras engineering service to survey safety radiation protection of the companies that carry out radiographic services of PETROBRAS are described. The systematic used in certification of personel, procedures, audits and field survey concerning radiation protection, are described. (C.M.).

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 19958, 19980, 20025, 20036, 20046, 20048, 20098, 20355, 20451, 21416, 21432, 21433, 21594

21333 **(ANL/PPRNT—89-119) On the use of standards with complex local symmetry for analysis of extended x-ray absorption fine structure.** McKale, A.G.; Knapp, G.S.; Chan, S.-K. (Argonne National Lab., IL (USA)). Nov 1985. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008400/JAW.

Accurate determination of structural parameters using the extended x-ray absorption fine structure technique requires the use of amplitude and phase information extracted from the spectra of chemically similar materials of known structure. The traditional extraction method only allows the use of compounds with very simple local symmetry. We present an extraction method that can be used on compounds with complex local symmetry. The method is then used on iron data and the extracted phase and amplitude information compared to theory. 15 refs., 3 figs.

21334 **(ANL/PPRNT—89-152) Ion beam mixing in metallic glasses at low temperatures.** Hahn, H.; de la Rubia, T.D.; Averback, R.S. (Argonne National Lab., IL (USA)). Mar 1987. Contract W-31109-ENG-38;AC02-76ER01198. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008351/JAW.

Measurements of ion beam mixing of tracer impurities in metallic glasses and in the pure crystalline elements comprising the glasses were performed at ~80 K. It was observed that the ion mixing efficiency of the tracer impurities was greater in the metallic glasses than in either of the constituent elements for the NiZr and CuEr systems, and that it was about the same for the NiTi system. It was also observed in the NiZr glass that the ion mixing efficiency is somewhat larger for Cu tracer impurities than Au tracer impurities, which is similar to their relative diffusivities during thermal annealing at elevated temperature. The results are consistent with the picture of cascade dynamics provided by recent molecular dynamics computer simulations. They show that the cascade region has a "liquid-like" structure during the thermal spike phase of the cascade evolution. 19 refs., 2 figs., 1 tab.

21335 **(CONF-8804141—7) Inner-shell excitation by channeled electrons.** Pennycook, S.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007822/JAW.

From 11. Werner Brandt workshop on penetration phenomena of charged particles in matter; Oak Ridge, TN, USA (14 Apr 1988).

An interesting situation occurs when inner shell electrons in crystalline materials are excited by electron beams of kilovolt energies in a transmission electron microscope. For many years the subsequent x-ray emission has been used as the basis of an analytical technique, giving compositional information at high spatial resolution. Recently this technique has been extended to provide information on impurity lattice site location, the basis of the technique being to take two fluorescence spectra, one under channeling conditions and one "random" spectrum with the crystal oriented away from strongly channeling planes or axes. Since electrons channel along the positive potential wells of the atomic planes or strings, a higher yield of characteristic x-ray emission is expected from the channeled case, for the same incident beam current. This channeling effect can be defined as the relative increase in x-ray yield. This paper discusses using channeled electron to excited inner-shell electrons. 4 refs., 3 figs.

21336 **(CONF-8809215—4) Grain-boundary and free-surface induced thermodynamic melting: A molecular dynamics study in silicon.** Phillpot, S.R.; Lutsko, J.F.; Wolf, D.; Yip, S. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007415/JAW.

From Atomistic modelling in materials - beyond pair potentials; Chicago, IL, USA (27 Sep 1988).

Molecular dynamics simulations in silicon show that thermodynamic melting is rapidly nucleated at a grain boundary and at a free surface. Such an observation is entirely consistent with experiment. 12 refs., 3 figs., 1 tab.

21337 **(ECN—209) Half-metallic ferromagnet NiMnSb; a positron-annihilation study.** Hanssen, K. (Netherlands Energy Research Foundation, Petten; Amsterdam Univ. (Netherlands)). Apr 1988. 110p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705969/JAW.

The electronic structure of NiMnSb is investigated by means of spin-polarized measurements of the angular correlation of annihilation radiation. NiMnSb is predicted to be a half-metallic ferromagnet. The experimental set-up and the application of the Korringa-Kohn-Rostoker (KKR) method to the calculation of the two-photon momentum density are discussed. To interpret the experimental data, the electronic structure, the Fermi surface and the two-photon momentum density have been calculated according to the KKR method. The calculations, based on self-consistent potentials evaluated according to the augmented-spherical-wave method, were performed scalar-relativistically. From the measured distribution the sum and difference of the spin-dependent momentum densities are obtained once integrated along three different directions in p(over->) space, namely <100>, <110> and <111>. The distributions show a clear impression of the majority-spin Fermi-surface. A good quantitative agreement between theory and experiment is established. From this analysis a value for the 'three-photon-difference effect' in NiMnSb is established of (8.4+-0.1).10/sup -3/. To test in particular the half-metallic nature of the band structure the experimental distributions are compared with theoretical ones obtained from modelled band structures in which small numbers of electrons near the Fermi level are transferred from one spin population to the other. The best agreement is obtained for a band occupation in which no electrons are transferred, i.e. for the half-metallic state. 27 figs., 167 refs., 7 tabs.

21338 **(FRCEA-TH—46) Three dimensional vortices and interfaces in Hele-Shaw cells.** Pumir, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique; Paris-6 Univ., 75 (France)). Jun 1987. 221p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88757203/JAW.

A model of nonviscous flow, based on the Biot-Savart equations is used to examine the existence of singularities in three dimensional, incompressible, hydrodynamic equations. The results suggest a fairly simple physical mechanism, which could lead to the formation of singularities in the nonviscous case: two vortex tubes with opposite circulations pair up and stretch each other, until the radii of the vortex cores become extremely small, causing a divergence of the vorticity. The cases of a perfect and a slightly viscous fluid are considered. The results are unclear as to whether the vorticity of a slightly viscous fluid can become infinite or not, and whether singularities exist. The dynamics of hydrodynamic interfaces are also investigated. The propagation of bubbles in a slightly viscous fluid, in a Hele-Shaw cell are described.

21339 **(HMI-P—88/20-HF-Prepr.) Introduction to PAC/PAD.** Mahnke, H.E. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik; Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). 1988. 30p. (CONF-880845—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88757130/JAW.

From Meeting on nuclear methods in magnetism; Munich, F.R. Germany (1 Aug 1988).

Both methods, Perturbed Angular Correlation (PAC) utilizing radioactive probes and Perturbed Angular Distribution (PAD) following nuclear reactions measure hyperfine interaction parameters and allow to study magnetism on a rather local scale. While both techniques are based on the same theory the underlying concepts are quite different. Examples on local moments, influence of the nearest-neighbor to the magnetic field in ferromagnets, knight shift in nonmagnetic materials, and magnetism in high-temperature superconductors and related oxides illustrate the recent developments within the methods and the improvements in their sensitivity and resolution.

21340 **(IC—88/196) Local field effects in the many-body perturbation theory and in the density functional theory.** Mazin, I.I. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705975/JAW.

The effect of exchange and correlation on the response processes in solids studied in homogeneous electron gas is extended for real systems, first of all for semiconductors. The static dielectric function of a semiconductor is estimated by the density functional theory. 10 refs.

21341 **(IC—88/333) Hydrostatic pressure dependence of elastic constants for lead fluoride crystal.** Singh, R.K.; Rao, C.N. (International Centre for Theoretical Physics, Trieste (Italy); Bhopal Univ. (India). School of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1988. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705985/JAW.

The variations of the second order elastic constants (SOEC) and longitudinal and shear moduli with hydrostatic pressure for the lead fluoride have been investigated theoretically, for the first time, by means of a three-body force potential (TBP) model. The significance of three-body interactions (TBI) has been clearly demonstrated in these investigations. The present TBP model has reproduced the pressure derivatives of the SOEC of PbF more satisfactorily than the shell model and other model calculations. (author). 24 refs, 3 figs, 2 tabs.

21342 **(IC—88/336) Model for hot electron phenomena: Theory and general results.** Carrillo, J.L.; Rodriquez, M.A. (International Centre for Theoretical Physics, Trieste (Italy); Universidad Autonoma de Puebla (Mexico). Inst. de Ciencias). (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1988. 37p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705986/JAW.

We propose a model for the description of the hot electron phenomena in semiconductors. Based on this model we are able to reproduce accurately the main characteristics observed in experiments of electric field transport, optical absorption, steady state photoluminescence and relaxation process. Our theory does not contain free nor adjustable parameters, it is very fast computerwise, and incorporates the main collision mechanisms including screening and phonon heating effects. Our description on a set of nonlinear rate equations in which the interactions are represented by coupling coefficients or effective frequencies. We calculate three coefficients from the characteristic constants and the band structure of the material. (author). 22 refs, 5 figs, 1 tab.

21343 **(IC—88/361) Long-range interactions in the compressible Heisenberg chain.** Ferrer, R. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1988. 20p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705992/JAW.

We investigate the effects of long-range Kac-Baker type interactions between the ions on the nonlinear coupled magnetic and elastic excitations of a compressible Heisenberg chain. (author). 7 refs, 4 figs.

21344 **(IC—88/395) Image-force effects in bimetallic systems.** Nafari, N.; Al-Kelsh, A.; Das, M.P. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1988. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705999/JAW.

We have modified the model density developed by Das and Nafari so as to account for the image-force effects. The charge rearrangements in the interfacial region and the interfacial energies are calculated via density functional formalism. The image-force terms as compared to our previous calculations increase the interfacial energies and give rise to slightly weaker adhesion. (author). 10 refs, 4 figs, 1 tab.

21345 (INIS-BR—1439, pp 26) **Study on nuclear magnetic resonance C/sup 13/ of pyridocarbazoles and benzopyridocarbazolas assigment.** Romeiro, G.A.; Ferreira, V.F. (Universidade Federal Fluminense, Niteroi, RJ (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

21346 (INIS-BR—1439, pp 27) **Study on nuclear magnetic resonance C/sup 13/ of pyroloquinones substitued assigment.** Romeiro, G.A.; Ferreira, V.F. (Universidade Federal Fluminense, Niteroi, RJ (Brazil)). 1987. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88705762/JAW. (CONF-8710449—).

From 27. Brazilian congress on chemistry; Rio de Janeiro, Brazil (4 Oct 1987).

21347 **(INIS-mf—11358) 31st Annual conference and the 21st annual theoretical seminar of the South African Institute of Physics.** (South African Inst. of Physics, Faure). 1986. 71p. (In English, Afrikaans). (CONF-8607352—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW.

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

The 31st annual conference and the 21st annual theoretical seminar of the South African Institute of Physics was held from 7-11 July 1986 at the Rand Afrikaans University, Johannesburg. This publication contains only the abstracts of seminars delivered on the conference. The topics that were covered include the various facets of physics such as solid state physics, nuclear and particle physics, optics and spectroscopy, solar-terrestrial physics, education, and applied and industrial physics.

21348 (INIS-mf—11358, pp 41) **Low-temperature Moessbauer-effect measurements on mixed iron-manganese oxides.** Hearne, G.R.; Albers, A.; Kolk, B. (University of the Witwatersrand, Johannesburg (South Africa). Dept. of Physics). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21349 (INIS-mf—11358, pp 40) **Moessbauer-effect studies of critical phenomena in metallic iron.** Kolk, B. (University of the Witwatersrand, Johannesburg (South Africa). Dept. of Physics). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21350 (INIS-mf—11358, pp 35) **Deep radiation damage in copper after ion implantation.** Friedland, E.; Le Roux, H.; Malherbe, J.B. (Pretoria Univ. (South Africa). Dept. of Physics). 1986. (In Afrikaans). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21351 (INIS-mf—11358, pp 46) **Theory of mesa-growth on ion implanted diamonds.** Prins, J.F.; Derry, T.E.; Sellschop, J.P.F. (De Beers Diamond Research Laboratory (South Africa); University of the Witwatersrand, Johannesburg (South Africa)). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21352 (INIS-mf—11358, pp 44) **Electrical characterization of defects caused by proton implantation on n- and p-type GaAs.** Nel, M.; Auret, F.D. (Port Elizabeth Univ. (South Africa). Dept. of Physics). 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705771/JAW. (CONF-8607352—).

From 31. annual conference on South African Institute for Physics; Johannesburg, South Africa (7 Jul 1986).

This publication contains only the abstracts of seminars.

21353 **(INIS-mf—11367) Magnetic resonance studies of the oxygen-vacancy complex and interstitial chromium in silicon.** Kemp, R. van. (Amsterdam Univ. (Netherlands)). 30 Jun 1988. 144p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706065/JAW.

Includes Dutch summary.

The methods, electron paramagnetic resonance (EPR) and electron nuclear double resonance (ENDOR) are used to investigate the electronic structure of irradiation defects and impurities in silicon. 145 refs.; 34 figs.; 18 tabs.

21354 **(INIS-mf—11369) Surface modification of yttria stabilized zirconia by ion implantation.** Scholten, D. (Technische Univ. Twente, Enschede (Netherlands)). 3 Apr 1987. 211p. NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS. Order Number DE88706067/JAW.

Includes Dutch summary.

The results of investigations of surface modification by ion implantation in zirconia are described. As dopant material, iron was investigated thoroughly. The depth distribution of implanted ions depends on implantation parameters and the dopant-matrix system. The investigations of thermal stability of some implanted iron profiles by RBS and AES are described. Special interest lies in the thermal stability under working conditions of the zirconia material (400-1000/sup 0/C). Radiation damage introduced in the implanted layer was investigated using transmission electron microscopy on polycrystalline material and channeling experiments on a single crystal implanted with iron. 179 refs.; 87 figs.; 20 tabs.

21355 **(INIS-mf—11375) Aqueous polyethylene oxide solutions. A nuclear magnetic relaxation study.** Breen, J. (Rijksuniversiteit Leiden (Netherlands)). 9 Dec 1987. 143p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706073/JAW.

Includes Dutch summary.

A number of aspects concerning the reorientation of polymer, water and ion hydration complexes have been studied in aqueous solution of polyethylene oxide (PEO). The polymer dynamics are investigated by /sup 1/H-PEO and /sup 13/C-PEO nuclear relaxation experiments. 162 refs.; 30 figs.; 19 tabs.

21356 **(INIS-mf—11380) Probing gas-surface interactions with a molecular beam.** Spruit, M.E.M. (Amsterdam Univ. (Netherlands)). 22 Jun 1988. 103p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706078/JAW.

Includes Dutch summary.

The dynamics of direct scattering, trapping and sticking in molecular beam scattering is probed. The O/sub 2//Ag interaction was chosen, using the close-packed (111) plane of Ag as target surface. 170 refs.; 22 figs.; 3 tabs.

21357 **(INIS-mf—11382) Carbon-supported iron and iron-molybdenum sulfide catalysts. A combined Moessbauer and hydrodesulfurization activity study.** Ramselaar, W.L.T.M. (Technische Univ. Delft (Netherlands)). 9 Jun 1988. 149p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88706080/JAW.

Includes Dutch summary.

The main objective was to describe the relations between the characteristics (composition and dispersion) of the actual sulfide phase and the catalytic activity. Attention was also paid to the influence of preparational aspects on these characteristics. The catalysts were characterized using in-situ Moessbauer spectroscopy down to 2.0 K. 254 refs.; 47 figs.; 22 tabs.

21358 **(INIS-mf—11387) Catastrophes in surface scattering.** Horn, T.C.M. (Amsterdam Univ. (Netherlands)). 28 Sep 1988. 173p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706085/JAW.

Includes Dutch summary.

Theoretical and experimental studies concerning atom-surface interactions in the energy range from hyperthermal to approximately 100 eV are reported. An extended study of the interaction of low energetic alkalis (sodium and potassium) with a silver crystal is presented. Finally the ultimate experimental result in this research, the first observation of catastrophes in surface scattering, is shown. The results clearly indicate the strength of the catastrophe analysis in gas-surface scattering. 218 refs.; 40 figs.; 170 schemes; 4 tabs.

21359 **(INIS-mf—11388) Moessbauer studies of nonlinear excitations and gold cluster compounds. An experimental investigation of non-linear excitations in Ising-like antiferromagnetic chain systems and of metal core atoms in polynuclear gold cluster compounds.** Smit, H.H.A. (Rijksuniversiteit Leiden (Netherlands)). 15 Jun 1988. 111p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706086/JAW.

Includes Dutch summary.

Moessbauer effect spectroscopy has been applied to the study of three polynuclear gold cluster compounds. The resulting information on the local vibrational density of states has been compared to several models which take the finite size of the particles into consideration. 188 refs.; 34 figs.; 103 schemes; 8 tabs.

21360 (INIS-SU—70, pp 24-26) **New orientational transitions in HoFeO/sub 3/ orthoferrite.** Balbashov, A.M.; Kozlov, G.V.; Lebedev, S.P.; Mukhin, A.A.; Pronin, A.Yu.; Prokhorov, A.S. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

Anomalies in magnon modes in HoFeO/sub 3/ at T/sub 1/ =58+-2 K, T/sub 2/=51+-1 K, T/sub 3/=39+-2 K are found. It is shown that they are caused by spin-reorientation phase transformations between Γ/sub 4/-Γ/sub 24/, Γ/sub 24/-Γ/sub 12/ and Γ/sub 12/-Γ/sub 2/ phases, respectively. No similar sequence of spontaneous phase transformations in orthoferrites had been observed yet. 12 refs.; 1 fig.

21361 (INIS-SU—70, pp 3-5) **Radiative transformations in a new laser LiYF/sub 4/ crystal with color centers.** Basiev, T.T.; Vakhidov, F.A.; Mirov, S.B. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

Processes of radiative transformation of color centres in LiYF/sub 4/ crystals are investigated. Charge states of the color centres responsible for an absorption band with peaks at 435 and 635 nm wavelengths are found out. 11 refs.; 2 figs.

21362 (INIS-SU—71, pp 38-39) **Detection of unusual spin reorientation induced by magnetic field in DyFeO/sub 3/.** Balbashov, A.M.; Marchukov, P.Yu.; Nikolaev, I.V.; Rudashevskij, E.G. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1988. (In Russian). NTIS (US Sales Only), PC A03/MF A01; INIS. Order Number DE89780069/JAW.

Kratkie soobshcheniya po fizike.; no. 4.

In Experimental and theoretical physics. Collection.

It is detected that in DyFeO/sub 3/ the vector of antiferromagnetism reorientates continuously in two mutually perpendicular planes, and transition from one plane into the other one is a first-order phase transformation. 6 refs.; 2 figs.

21363 (INIS-SU—71, pp 3-5) **Photoluminescene and optical absorption in α-Si:H films implanted with rare earth elements.** Akimchenko, I.P.; Karryev, A.N. 1988. (In Russian). NTIS (US Sales Only), PC A03/MF A01; INIS. Order Number DE89780069/JAW.

Kratkie soobshcheniya po fizike.; no. 4.

In Experimental and theoretical physics. Collection.

Photoluminescence and optical absorption in α-Si:H films implanted with Sm, Nd and Yb ions are studied. It is found that luminescence caused by intracentral luminescence caused by intracentral transitions in rare earth atoms is not observed in α-Si:H films. In films implanted with Yb a new photoluminescence line at 1.0 eV due to, obviously, a defect with Yb and H atoms is detected. 3 refs.; 4 figs.

21364 (IPNO-DRE—87-33, pp 1-2) **Spontaneous desorption and plasma desorption mass spectrometry: a simple way to compare keV and MeV ion induced desorption.** 1987. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW. (CONF-8705114—; CONF-8709132—; CONF-8709414—).

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

Spontaneous and simultaneous emission of negative ions and electrons in a time of flight mass spectrometer was used to compare keV and MeV ion induced desorption. Results obtained with composite films of Cd arachidate layers superposed by monolayers of Cd stereate show that the molecular ion yield of the top layer (stearic acid) increases with the number of layers of the same compound in the Cf252 mode, but decreases strongly in the SD mode. A strong difference betwen Cf252 and SD is also observed in the molecular ion yield of arachidic acid. Mass spectra for two targets consisting of 2 ML of CD stereate on 2 ML of Cd arachidate and on 12 ML of Cd arachidate are shown. They suggest that there are more in flight fragmentations in fission fragment induced desorption than in keV ion induced desorption. It is assumed that more internal energy is on the average transferred to the molecular ions when they are emitted from the layers bombarded by MeV ions.

21365 (IPNO-DRE—87-33, pp 3-4) **Thickness and volume effects in MeV ion induced desorption (PDMS).** 1987. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW. (CONF-8705114—; CONF-8709132—; CONF-8709414—).

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

The origin of ion emission in MeV ion induced desorption was investigated using Cd stearate and arachidate molecules to prepare targets. Experiments were performed with fission fragments from a Cf252 source and 1.16 MeV/u Kr ions accelerated by a linear accelerator. The variation of the ion yield from composite films as a function of the Langmuir-Blodgett film thickness of the same molecule, as well as the decrease of the yield for ions from subsurface layers are compatible with an emission from a conical volume of 200A depth.

21366 (IPNO-DRE—87-33, pp 14) **Fast ion desorption (Mev/u): interaction depth in secondary H+ ion emission: probe of the surface-projectile interaction.** 1987. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW. (CONF-8705114—; CONF-8709132—; CONF-8709414—).

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

The emission of ions resulting from the bombardment of solid targets by 1 MeV/u projectiles was studied by time of flight spectrometry to examine the energy transfer process from the interior of a material towards the surface. Results show an interaction depth between the primary ion and the material which varies according to the type of secondary ion emitted. The depth calculated using a model is 200 A for agregates emitted from a CsI target bombarded by a Kr 18/sup +/ beam. The estimates were verified using an H/sup +/ probe.

21367 (IPNO-DRE—87-33, pp 13) **Secondary ion emission from surface and volume with high and low energy ions.** 1987. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88757014/JAW. (CONF-8705114—; CONF-8709132—; CONF-8709414—).

From 35. conference on mass spectrometry and applied topics; Denver, CO, USA (24 May 1987).

Secondary ion emission from fast ion impact (Cf252 fission fragments) of Langmuir-Blodgett films consisting of superposed two molecule layers with similar structure and mass (Cd stereate and Cd arachidate) was analyzed. Emission of deproton secondary ions of stereate and arachidate acids was studied for various target configurations. Results show that under the influence of high energy ions, secondary ion ejection comes from a conical volume of 200A depth.

21368 **(LBL—26617) Study of semiconductor valence plasmon line shapes via electron energy-loss spectroscopy in the transmission electron microscope.** Kundmann, M.K. (Lawrence Berkeley Lab., CA (USA)). Nov 1988. Contract AC03-76SF00098. 198p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008152/JAW.

Electron energy-loss spectra of the semiconductors Si, AlAs, GaAs, InAs, InP, and Ge are examined in detail in the regime of outer-shell and plasmon energy losses (0--100eV). Particular emphasis is placed on modeling and analyzing the shapes of the bulk valence plasmon lines. A line shape model based on early work by Froehlich is derived and compared to single-scattering probability distributions extracted from the measured spectra. Model and data are found to be in excellent agreement, thus pointing the way to systematic characterization of the plasmon component of EELS spectra. The model is applied to three separate investigations. 82 refs.

21369 **(ORNL/TM—10867) Triple ion beam irradiation facility.** Lewis, M.B.; Allen, W.R.; Buhl, R.A.; Packan, N.H.; Cook, S.W.; Mansur, L.K. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 88p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007894/JAW.

A unique ion irradiation facility consisting of three accelerators is described. The accelerators can be operated simultaneously to deliver three ion beams on one target sample. The energy ranges of the ions are 50 to 400 keV, 200 keV to 2.5 MeV, and 1.0 to 5.0 MeV. Three different ions in the appropriate mass range can be simultaneously implanted to the same depth in a target specimen as large as 100 mm^2 in area. Typical depth ranges are 0.1 to 1.0 μm. The X-Y profiles of all three ion beams are measured by a system of miniature Faraday cups. The low-voltage accelerator can periodically ramp the ion beam energy during the implantation. Three different types of target chambers are in use at this facility. The triple-beam high-vacuum chamber can hold nine transmission electron microscopy specimens at elevated temperature during a irradiation by the three simultaneous beams. A second high-vacuum chamber on the medium-voltage accelerator beamline houses a low- and high-temperature translator and a two-axis goniometer for ion channeling measurements. The third chamber on the high-energy beamline can be gas-filled for special stressed specimen irradiations. Special applications for the surface modification of materials with this facility are described. Appendixes containing operating procedures are also included. 18 refs., 27 figs., 1 tab.

21370 **Generalized expressions for the calculation of elastic constants by computer simulation.** Lutsko, J.F. (Material Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Applied Physics;* **65**: No. 8, 2991-2997(15 Apr 1989).

The general expressions, valid for any potential, for the calculation of elastic constants through computer simulation are given. At zero temperature, the elastic constants are found to be the sum of a generalization of the Born term and a term accounting for internal relaxations that arise when a system with more than one atom in the primitive unit cell is strained. The fluctuation formulae used in finite temperature simulations are found to be straightforward generalizations of those used for pair potentials. The connec-

tion between the finite-temperature and zero-temperature methods is also made.

21371 **Island films resulting from ion bombardment: Spectroscopic ellipsometry and Auger electron spectroscopy.** Armstrong, M.J.; Muller, R.H. (Lawrence Berkeley Laboratory and Department of Chemical Engineering, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **65**: No. 8, 3056-3060(15 Apr 1989).

The effects of ion bombardment on the morphology of compact lead films of under 100 nm thickness were investigated by spectroscopic ellipsometry, Auger electron spectroscopy (AES), and scanning electron microscopy (SEM). In contrast to the expected uniform removal of the surface by ion bombardment, on which the determination of composition profiles by AES is based, a nonuniform removal of material with the formation of pits or islands has been found to occur. The pitting is independent of the film preparation or the presence of an oxide overlayer. SEM confirmed the island nature of the surface. Spectroscopic eillipsometer and AES measurements agree well when interpreted in terms of surface coverage. Thus supporting the validity of the coherent superposition model for interpreting ellipsometer measurements of island films.

21372 **Optical-emission-spectroscopic studies of the sputtering of Y-Ba-Cu-oxide thin films.** Fleddermann, C.B. (Sandia National Laboratories, Albuquerque, New Mexico 87185 and Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico 87131). *Journal of Applied Physics;* **65**: No. 7, 2861-2863(1 Apr 1989).

Optical emission spectroscopy is used to determine the identity of species ejected during sputtering of a composite Y-Ba-Cu-oxide target. In this experiment, Y, Ba, Cu, Ba^+, and YO were detected near the surface of the target, indicating that oxygen is transported to the substrate during sputtering. Varying of the sputter ion energy caused some variation in relative peak heights, but changing the gas mixture in the system did not significantly alter the spectra.

21373 **Use of thorium as a target in electron-spin analyzers.** McClelland, J.J.; Scheinfein, M.R.; Pierce, D.T. (National Institute of Standards and Technology,, Gaithersburg, Maryland 20899). *Review of Scientific Instruments;* **60**: No. 4, 683-687(Apr 1989).

Measurements of the effective Sherman function have been carried out for 10—100-keV spin-polarized electrons scattering from a thick thorium target in a retarding Mott analyzer. At 20 and 100 keV the dependence on the maximum energy loss accepted by the detector has been measured. Comparison is made with scattering from a 1250-A gold film. Thorium is seen to have a S/sub eff/ up to 30% higher than gold. This higher S/sub eff/ can not only improve the figure of merit of a spin detector, but also lessen its sensitivity to instrumental asymmetries. Comparison is also made with preliminary theoretical results. Good agreement between theory and experiment is seen in the thorium Sherman function relative to that of gold.

21374 **Spin-polarized metastable-atom deexcitation spectroscopy: A new probe of the dynamics of metastable-atom—surface interactions.** Hart, M.W.; Hammond, M.S.; Dunning, F.B.; Walters, G.K. (Department of Physics and the Rice Quantum Institute, Rice University, Houston, Texas 77251). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 8, 5488-5491(15 Mar 1989).

Spin-labeling techniques, specifically the use of electron-spin-polarized metastable atoms coupled with spin analysis of the ejected electrons, are used to probe the dynamics of metastable atom-surface interactions. In particular,the data show that the electrons involved in Auger neutralization tend to have antiparallel spins and that secondary electrons can provide a significant contribution to the total ejected electron signal.

21375 **New, real-space, multiple-scattering-theory method for the determination of electronic structure.** Zhang, X.; Gonis, A. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60201). *Physical Review Letters;* **62**: No. 10, 1161-1164(6 Mar 1989).

We introduce a new method for the exact and unified treatment of the Schroedinger equation and the calculation of the electronic density of states of materials with reduced symmetry (e.g., surfaces and interfaces) many of which are outside the reach of methods based on Bloch's theorem. This method is based on a self-consistent equation determining the t matrices of those parts of a system characterized by semi-infinite periodicity, without recourse to reciprocal space. The method is illustrated through a calculation of the density of states for bulk Cu and for a (100)/(111) planar Cu interface.

21376 **Evidence for a phase transition in the zero-temperature anisotropic two-dimensional Heisenberg antiferromagnet.** Barnes, T.; Kotchan, D.; Swanson, E.S. (Department of Physics, University of Toronto, 60 St. George Street, Toronto, Ontario, Canada M5S 1A7). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4357-4362(1 Mar 1989).

We describe a Monte Carlo study of the ground state of of the two-dimensional anisotropic Heisenberg antiferromagnet. Values of the energy per spin and the rms z-italic-circumflex-staggered magnetization are determined for a range of transverse couplings. At zero temperature the isotropic point $g = 1$ apparently separates two phases having nonzero and zero z-italic-circumflex-staggered magnetization for $g<1$ and $g>1$, respectively. This may imply that the isotropic Heisenberg antiferromagnet is unsuitable as a model of the precursor insulators of the high-temperature superconductors. We also compare our results with previous conjectures regarding the ground state of the anisotropic system.

21377 **Field-enhanced disorder in a ferromagnet with random-axis anisotropy.** Huber, D.L.; Ching, W.Y. (Department of Physics, University of Wisconsin—Madison, Madison, Wisconsin 53706). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4453-4456(1 Mar 1989).

We investigate the harmonic magnon modes in a model ferromagnet with random-axis anisotropy. Using a numerical approach, we calculate the density of states and characterize the localization of the eigenfunctions. It is shown that, when the anisotropy is large, applying a saturating field greatly enhances the effects of the disorder introduced by the anisotropy.

21378 **Effective conductivity of anisotropic two-phase composite media.** Sen, A.K.; Torquato, S. (Department of Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, North Carolina 27695-7910). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4504-4515(1 Mar 1989).

We derive a new perturbation expansion for the effective conductivity tensor σ/sub e/ of a macroscopically anisotropic d-dimensional two-phase composite of arbitrary microstructure. The nth-order tensor coefficients ssA/sub n//sup (//sup i//sup)/ of the expansion (termed n-point microstructural parameters) are given explicitly in terms of integrals over the set of n-point probability functions (associated with the ith phase) which statistically characterize the microstructure. Macroscopic anisotropy arises out of some asymmetry in the microstructure, i.e., due to statistical anisotropy (e.g., a distribution of oriented, nonspherical inclusions in a matrix, layered media, such as sandstones and laminates, etc.). General and useful properties of the n-point microstructural parameters are established, and contact is made with the formal results of Milton. We then derive rigorous nth-order bounds on σ/sub e/ (from our perturbation expansion) that depend upon the n-point parameters ssA/sub n//sup (//sup i//sup)/ for $n = 1, 2, 3,$ and 4. This is the first time that such bounds (for $n>1$) have been explicitly given in terms of the ssA/sub n//sup (//sup i//sup)/.

21379 **Phase diagram of the half-filled 3D Hubbard model.** Scalettar, R.T.; Scalapino, D.J.; Sugar, R.L.; Toussaint, D. (Department of Physics, University of Illinois, Urbana, Illinois 61801). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4711-4714(1 Mar 1989).

The antiferromagnetic Neel temperature T/sub N/ is calculated as a function of the Coulomb interaction U for a half-filled 3D Hubbard model. Numerical results are given for the specific heat and staggered magnetic suspectibility on periodic lattices rang-

ing from 4^3—10^3 sites, and used to determine T/sub N/. The size dependence of the results suggests that the transition is weakly first order at small to intermediate values of U.

21380 **Exact diagonalization study of the frustrated Heisenberg model: A new disordered phase.** Dagotto, E.; Moreo, A. (Institute for Theoretical Physics, University of California at Santa Barbara, Santa Barbara, California 93106). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4744-4747(1 Mar 1989).

The spin-(1/2 frustrated Heisenberg model is studied on a square lattice using the modified Lanczos technique. Frustration is introduced in the system through an additional coupling along the diagonals of the plaquettes. On a 4 x 4 lattice the ground state smoothly interpolates between two asymptotic Neel-like limits. However, on a narrow region of parameter space we find that the lowest-lying levels above the ground state are singlets rather than triplets, suggesting the existence of a new phase in the thermodynamic limit.

21381 **Two-dimensional angular correlation of annihilation radiation study of positron interactions with surfaces of aluminum.** Chen, D.M.; Berko, S.; Canter, K.F.; Lynn, K.G.; Mills A.P. Jr.; Roellig, L.O.; Sferlazzo, P.; Weinert, M.; West, R.N. (City College of the City University of New York, Convent Avenue, New York, New York 10031). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 3966-3989(1 Mar 1989).

Studies were made of the interactions of positrons with three low index surfaces of aluminum [(100), (110), and (111)] at room temperature with the aluminum surface at elevated temperatures and with oxygen adsorption on the aluminum surface. Our measurements using the improved two-dimensional angular correlation of annihilation radiation technique on surfaces support three established processes: spontaneous positronium (Ps) formation and emission, positrons bound in a surface state, and surface-state positrons thermally desorbed as Ps atoms. A method has been developed to accurately separate these components. The positron surface-state annihilation spectra are nearly isotropic for all three Al surfaces, which indicates a lateral localization and is inconsistent with either the ideal image-potential-induced bound state or the physisorbed Ps state. The thermal Ps momentum distributions agree well with the thermostatistical emission mechanism. The momentum distributions of the directly emitted Ps atoms are found to be very sensitive to the surface conditions, and to reflect the electron density of states near the surfaces, thus suggesting a new surface spectroscopy, angle-resolved Ps spectroscopy.

6561 Superconductivity

REFER ALSO TO CITATION(S) 19959, 19979, 19980, 19991, 20010, 20016, 20017, 20018, 20020, 20021, 20022, 20023, 20026, 20027, 20029, 20030, 20031, 21376

21382 **(ANL/PPRNT—89-91) Second order structural transition in La/sub 2-x/M/sub x/CuO_4.** Dabrowski, B. (Argonne National Lab., IL (USA)). Feb 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008430/JAW.

A simple Landau mean-field theory is applied to the structural phase transition in La_2CuO_4. The theoretical analysis predicts a two stage model for the transition as a possible explanation for the experimentally observed decrease of the superconducting temperature in the region adjacent to a transition to the non-metallic phase in doped samples of La/sub 2-x/M/sub x/CuO_4. 10 refs., 1 fig.

21383 **(ANL/PPRNT—89-143) Transverse sound in a magnetic field in UPt_3.** Shivaram, B.S.; Jeong, Y.H.; Rosenbaum, T.F.; Hinks, D.G.; Schmitt-Rink, S. (Argonne National Lab., IL (USA)). Jan 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008339/JAW.

We have propagated transverse sound in a magnetic field in the basal plane of UPt_3, with the polarization vector oriented both in the basal-plane and perpendicular to it. We observe a strong anisotropy in the magnetic field dependence of the attenuation for the two polarizations. In a simple phenomenological model we can understand the low temperature field dependence as a natural consequence of the anisotropy with temperature in zero-field reported by us earlier. However, for increasing T, there are significant deviations from this model which are probably related to the non-standard behavior of the upper critical field in the basal plane of UPt_3. 18 refs., 3 figs.

21384 **(ANL/PPRNT—89-144) 2-D ACAR measurements of Ni_3Al.** Smedskjaer, L.C.; DasGupta, A.; Legnini, D.G.; Stahulak, M.D. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008338/JAW.

In connection with a detailed study of the electronic structure and stability of the aluminides $(Ni,Fe)_3Al$, 2-D ACAR positron annihilation measurements were made on a Ni_3Al single crystal to study the Fermi surface. The results for Ni_3Al have been compared with results for pure Ni. Strong similarities were found for the electronic structures of these materials. Theoretical calculations of the Fermi surface for Ni_3Al are in good agreement with the experimental results. The Γ_{16} sheet, not previously observed in any experiment, has now been observed for the first time in Ni_3Al. 14 refs., 10 figs.

21385 **(ANL/PPRNT—89-174) Thermochemistry of the electron-paired, diamagnetic state of superconductivity.** Thorn, R.J. (Argonne National Lab., IL (USA)). [1989]. Contract W-31109-ENG-38. 25p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008476/JAW.

A thermochemical treatment of the electron-paired, diamagnetic state of superconductivity shows that for certain values of the BCS gap-energy at O K,Δ/sub o/, and the electron density, N, the ratio of the concentration of pairs at T and O K, P(T), varies sigmoidally so that the state changes rapidly from one of single electrons to one of paired electrons when the temperature is decreased. 12 refs., 3 figs.

21386 **(CTA-IEAV-NT—014/86) Small hydrogen liquefier.** Airoldi, V.J.T.; Corat, E.J.; Minucci, M.A.S.; Leite, V.S.F.O. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Sep 1986. 28p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705423/JAW.

In this work the deign and construction of a small hydrogen liquefier (two liters per hour maximum production) is described. The isenthalpic expansion process is used, because its construction is simple and it is generally cheaper to operate. A comparison with other liquefier processes, and considerations about their basic theory are also presented.

21387 **(LA-UR—89-501) Fermi liquid theory for high temperature superconductors.** Bedell, K.S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-8810299—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007982/JAW.

From Interacting electrons in reduced dimensions; Torino, Italy (3 Oct 1988).

In this article the Fermi liquid theory of metals is discussed starting from Luttinger's theorem. The content of Luttinger's Theorem and its implications for microscopic theories of high temperature superconductors are discussed. A simple quasi-2d Fermi liquid theory is introduced and some of its properties are calculated. It is argued that a number of experiments on YBa_2Cu_3O/sub 6+x/, x > 0.5, strongly suggest the existence of a Fermi surface and thereby a Fermi liquid normal state. 25 refs., 1 fig.

21388 **Harmonic generation and flux quantization in granular superconductors.** Lam, Q.H.; Jeffries, C.D. (Physics Department, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4772-4775(1 Mar 1989).

Simple dynamical models of granular superconductors are used to compute the generation of harmonic power in ac and dc magnetic fields. In zero order, the model is a single superconducting loop, with or without a weak link. The sample-average power is predicted by averaging over suitable distribution functions for loop areas and orientations in a dc magnetic field. In a first-order model, inductance and resistance are also included. In all models the power at high harmonics shows strikingly sharp dips periodic in the dc field, revealing flux quantization in the prototype loops.

21389 **Calculation of interband optical conductivity of $Tl_2CaBa_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O$/sub 10/ superconductors.** Zhao, G.; Ching, W.Y.; Wong, K.W. (Department of Physics, University of Missouri: Kansas City, Kansas City, Missouri 64110). *Journal of the Optical Society of America B: Optical Physics;* **6**: No. 3, 505-512(Mar 1989).

The interband optical conductivities of $Tl_2CaBa_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O$/sub 10/ superconductors are calculated by using a first-principles method. The results for the two compounds are quite similar, both showing strong anisotropy behavior and a strong momentum matrix effect. The complex dielectric function, the electron energy-loss function, and the reflectivity spectrum are then derived. The values of the static dielectric constant ϵ_0 and the plasmon frequency ω/sub p/ are also obtained. These optical properties are discussed together with similar results for the $YBa_2Cu_3O_7$ and $Bi_2CaSr_2Cu_2O_8$ superconductors. Implications of these results on the possible mechanism in these compounds are discussed.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 19674, 20259, 20264, 20941, 21031, 21050, 21571, 21580

21390 **(ANL/PPRNT—89-148) Self-consistent theory for the dielectric and the magnetic exchange and correlation effects in electron gas.** Dabrowski, B. (Argonne National Lab., IL (USA)). Apr 1987. Contract W-31109-ENG-38. 38p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008458/JAW.

A wave-vector-dependent local-field factors (LFF) which enter the expressions for the dielectric function and the spin susceptibility response function of an electron liquid are studied. An exact expression in the $q \rightarrow 0$ limit for the symmetric and the antisymmetric LFF are derived by the use of equations of motion for the spin-densities. The proof that these LFF satisfy compressibility and susceptibility sum rules is based on the novel virial theorems for the two-component system. The relation of exact LFF to earlier approximations, to other exactly derived LFF and to spin-density functional theory is examined. 29 refs.

21391 **(CTA-IEAV-NT—04/86) Resolution of Laplace equation in a region containing plane and cylindrical charged plates.** Jesus Paes, A.C. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). May 1986. 23p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705417/JAW.

A computational program to solve the Laplace equation, in two dimensions, was developed. Cylindrical coordinates were used and the electric potential was calculated in a region bounded by an eccentric circunference that is grounded and in this region there were electrodes at known potential. The iterative method of Gauss-Seidel was used to solve the equation and the matrix of the coefficients, a sparse matrix, was stored in a compacted form in three line matrices. The distribution of this electric field were obtained from the potential and a subroutine to draw was developed.

21392 **(DOE/ER/13897—3) A new microscopic level of irreversibility?.** Prigogine, I. (Texas Univ., Austin (USA). Center for Studies in Statistical Mechanics). 1987. Contract FG05-88ER13897. 12p. (CONF-8709409—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006587/JAW.

From Spatial inhomogeneities and transient behavior in chemical kinetics; Brussels, Belgium (4 Sep 1987).

In this paper, the non-exponential decay is analyzed with the help of simple computer experiments performed by T. Petrosky, simulating classical radiation damping. The non-exponential decay is studied and shown to depend on the preparation of the system. However, whatever the initial preparation, the system reaches the decay predicted by classical radiation theory after a short time we call the Zeno's time. The similitude of Petrosky's results with computer experiments for the approach to equilibrium in many-body systems is emphasized. However, while there one deals with times which are multiple of the relaxation time, the irreversibility manifest in radiation theory occurs always over a much shorter time scale, the Zeno's time. In atomic systems, this would be a time order of 10/sup {minus}18/ seconds. These results are of great interest for the understanding of the microscopic mechanism of radiation. Let us consider a charged oscillator. In a first stage, this oscillator has to produce the field oscillators to which it may transfer energy through the usual resonance mechanism. Radiation appears therefore as a kind of non linear autocatalytic process, involving a self-organization mechanism. The behavior during the Zeno period can be explained easily in terms of subdynamics as introduced by the Brussel's group. We see that there is no transition from reversibility to irreversibility. Irreversible processes start at the very moment at which the system is prepared. It is important to stress that an unstable particle is itself the result of irreversible processes. As a result, an unstable particle (or an excited atomic state) can no more be described in terms of wave functions, as irreversible processes are not included in Schroedinger's equation. 14 refs., 3 figs.

21393 **(DOE/ER/40265—21) Soft goldstone excitations in finite volumes applications from eV to TeV physics.** Neuberger, H. (Rutgers--the State Univ., Piscataway, NJ (USA). Dept. of Physics and Astronomy). 1988. Contract FG05-86ER40265. 4p. (CONF-8808145—27). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007324/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Finite site soft pion theorems are reviewed with special emphasis on applications. These range from quantum models relevant for high T/sub C/ superconductivity to classical models relevant for the symmetry breaking sector of the standard model. 8 refs.

21394 **(DOE/ER/40265—22) Overrelaxation and mode-mode coupling.** Neuberger, H. (Rutgers--the State Univ., Piscataway, NJ (USA). Dept. of Physics and Astronomy). 1988. Contract FG05-86ER40265. 5p. (CONF-8809247—6). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007230/JAW.

From Lattice '88: symposium on lattice field theory; Batavia, IL, USA (22 Sep 1988).

Overrelaxation is discussed in the dynamical renormalization group framework. 5 refs.

21395 **(IC—88/242) Use of the Fox derivatives in the solution of the word problem for groups.** Majumdar, S. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 6p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705978/JAW.

Applying Fox's free partial derivative, the word problem of a finitely presented group has been reduced to the problem of finding an algorithm for determining the existence of a root of a system of linear equations over the integral group ring. The solubility of the word problem for torsion-free one-relator groups and torsion-free polycyclic-by-finite groups has been deduced. (author). 10 refs.

21396 **(IC—88/245) Generalized Freiheitsatz.** Majumdar, S. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1988. 7p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705979/JAW.

A simple proof of Magnus' Freiheitsatz for one-relator groups is given which can be easily applied with slight modifications to prove a generalization of the theorem to any number of relators. (author). 10 refs.

21397 **(IC—88/318) Bound states of the potential V(r)=-Ze/sup 2//(r+β).** Ray, P.P.; Mahata, K. (International Centre for Theoretical Physics, Trieste (Italy); Visvabharati Univ., Santiniketan (India). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705983/JAW.

Energy eigenvalues of various states from n=1 to n=4 have been calculated in the framework of shifted 1/N expansion method. Results for s states are compared with those of Mehta and Patil for small β values. A new approximate formula has been developed for a quick estimate of energy eigenvalues for any angular momentum state. (author). 22 refs, 2 tabs.

21398 **(IC—88/331) Stability of self-gravitating systems consisting of two kinds of fermions.** Jin Kejian; Zhang Yuanzhong. (Northern Jiaotong Univ., Beijing (China). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1988. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705984/JAW.

We discuss static equilibrium and infinitesimal radial motion of self-gravitating systems consisting of two kinds of fermions with different masses. Calculation shows that static equilibrium configurations occur in a wide domain of values of central mass density and the domains, in which all equilibrium configurations are stable against radial perturbations, are obtained. (author). 7 refs, 3 figs.

21399 **(IC—88/345) Transition of anharmonic oscillator system from regular to irregular classical motion and the behaviour of its corresponding quantum system.** Li Jianling; Zhou Rongyu. (Tianjin Univ. (China). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705988/JAW.

The Lyapunov exponents of two-dimensional anharmonic oscillator systems are studied through numerical calculations. The result shows that the systems consist of regular and irregular regions in phase space in classical limit. The corresponding quantum systems are investigated. The distribution P(s) of spacings between adjacent energy levels indicates corresponding transition from Poisson-like distribution to Wigner-like distribution. P(s) is dependent on the total irregular fraction of phase space. (author). 9 refs, 6 figs.

21400 **(IC—88/351) Some asymptotic properties of functions holomorphic in tubular domains.** Zavialov, B.I. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1988. 5p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705989/JAW.

For the function holomorphic in curved tubular domain the connection between asymptotic behaviour of real part of its boundary value at a given point of base manifold and asymptotic behaviour of the whole function from the inside of this domain is studied. (author). 3 refs.

21401 **(IFIN-FT—304-1987) New approach in the study of transport equations.** Dita, P. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Apr 1987. 19p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706028/JAW.

It is shown that the solution of some boundary value problems for time independent transport equations can be obtained from the solution of the equivalent integral equations.

21402 **(IFIN-FT—307-1987) Classical analogue of the Hannabuss-Konstant-Okubo operator.** Iosifescu, M.; Scutaru, H. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Jun 1987. 5p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706029/JAW.

A classical analogue Ksub(f,rho) of the Hannabus-Konstant-Okubo (HKO) operator is defined for any pair (f,rho) in which f is a Poisson bracket realization and rho is a representation of a semisimple Lie algebra. (authors).

21403 **(IFIN-FT—308-1987) Adiabatic thorem and spectral concentration. II. Arbitrary order asymptotic invariant subspaces and block diagonalisation.** Nenciu, G. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Jun 1987. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706030/JAW.

We give a hierarchy of adiabatic theorems as well as a block diagonalization scheme.

21404 **(IFIN-FT—309-1987) Toward a proof of the existence of an integrity basis for the tensors in the enveloping algebra of su(3).** Scutaru, H. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Jun 1987. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706031/JAW.

It is proved that the zero weight multiplicities and generalized exponents of the su(3)-algebra coincide with those predicted from the hypothesis of the existence of an integrity basis for the su(3)-submodules of the enveloping algebra of su(3).

21405 **(IFIN-FT—310-1987) Degenerate representation from tensorial identities and quantum realisations of YBZF algebras.** Iosifescu, M.; Scutaru, H. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Jun 1987. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706032/JAW.

The second- degree irreducible tensors in the enveloping algebra of the classical semisimple Lie algebras are determined and the irreducible representations on which these tensors vanish are derived.(authors).

21406 **(IFIN-FT—313-1987) Statistical mechanics of low-dimensional Ginzburg-Landau fields. Some new results.** Barsan, V. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Aug 1987. 31p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706033/JAW.

The Ginzburg-Landau theory for low-dimensional systems is approached using the transfer matrix method. Analitical formulae for the thermodynamical quantities of interest are obtained in the one-dimensional case. An exact expression for the free energy of of a planar array of linear chains is deduced. A good agrement with numerical and experimental data is found.(authors).

21407 **(IFIN-FT—314-1987) Total divergence Lagrangeans and Poincare Cartan form in classical field-theory.** Popp, O.T.; Grigore, D.R. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Aug 1987. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706034/JAW.

The most general Lagrangean in classical field theory which gives identities for Euler-Lagrange equations is determined. This suggests an interesting Poicare-Cartan form for the study of symmetries.(authors).

21408 **(IFIN-FT—317-1987) Symmetries in the Lagrangean formalism.** Grigore, D.R. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Sep 1987. 33p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706035/JAW.

We generalize the analysis of Levy-Leblond for lagrangean systems with symmetry. We prove that this analysis goes through practically unchanged and after that we analyse in detail some examples.

21409 **(IFIN-FT—318-1987) Luttinger model with finite-range potential.** Barsan, V. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Sep 1987. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706036/JAW.

It is proved that the physics of the Luttinger model is insensitive to the variation of the range of potential. New exact Luttinger Green functions are computed.

21410 **(IFIN-FT—319-1987) Theorem in cohomology for elementary classical systems.** Popp, O.T. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Oct 1987. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706037/JAW.

A theorem in cohomology of Lie groups is proved. It is useful for describing the Lagrangeans of elementary classical systems.

21411 **(IFIN-FT—320-1987) Localizability and covariance in analytical mechanics.** Grigore, D.R. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Oct 1987. 22p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706038/JAW.

Two familiar concepts in quantum mechanics, namely localizability and covariance, are investigated in the framework of classical mechanics. The analysis of well known problems in quantum mechanics asa localizability of elementary relativistic particles gives the same result in classical mechanics as well.

21412 **(IFIN-FT—321-1987) Conductivity of the Tomonaga-Luttinger model.** Barsan, V. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Nov 1987. 25p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706039/JAW.

Mattis' method for computing the conductivity is applied to the spin dependent bifermionic system. The connections between the conductivities of a Tomonaga-Luttinger model with or without a large momentum transfer term are given. The possible experimental relevance of these results is discussed.

21413 **(IFIN-FT—322-1987) Degenerate representations from quantum kinematical constraints.** Iosifescu, M.; Scutaru, H. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Nov 1987. 8p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88706040/JAW.

We present a systematization of previous results concerning the finite-dimensional irreducible L-modules, for semisimple Lie algebras, on which the second-degree irreducible tensors from the enveloping algebra U(L) vanish.(authors).

21414 **(IFIN-FT—329-1988) E/sup +/e/sup -/ pair resonant production in heavy ion collisions. A theoretical scenario.** Ixaru, L.G. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Mar 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706044/JAW.

The periodicity effect in the two-centre Dirac problem is here analyzed from a physicist's point of view. Some usual physical interpretations and natural assumptions are introduced which collectively lead to the idea that the e/sup +/ e/sup -/ pair creation in heavy ion collisions is a heated vacuum de-excitation process.

21415 **(IFTM-FT—306-1987) Some consequences of generalised moment inequalities: mass-and charge-response and correlation functions in multicomponent systems.** Manolescu, A.; Mezincescu, G.A. (Central Inst. of Physics, Bucharest (Romania). Inst. for Physics and Technology of Materials). May 1987. 36p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706052/JAW.

The best possible constraints of the static response in terms of two particle correlation functions, which follow from their integral representation, are analysed for homogeneous states of multicomponent systems of charged particles.(authors).

21416 **(ILL-RA—1987) Annual report 87.** (Institut Laue-Langevin, 38 - Grenoble (France)). 1988. 190p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88757013/JAW.

Research in theoretical condensed matter physics and nuclear physics; nuclear structure; fission; the free neutron; astrophysics; solid state physics (dynamical properties of ordered structures and magnetic systems); crystallography; liquids, disordered, and defect materials; biochemistry; and chemistry is summarized. Departments and services of the institute are described. Instrumentation and facilities are presented.

21417 **(INIS-BR—1424) Proceedings of the 9. National Meeting of Particle Physics and Fields.** (Sociedade Brasileira de Fisica, Sao Paulo, SP). 1988. 36p. (In Portuguese). (CONF-8809300—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW.

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

Some papers about particle physics and field theories are presented. The enphasis is given to current parton models and nonabelian theories (L.C.).

21418 (INIS-BR—1424, pp 5) **Some results of an expansion for the heat kernel.** Malbouisson, A.P.C.; Simao, F.R.A.; Camargo Filho, A.F. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21419 (INIS-BR—1424, pp 5) **SO(2,1) Lie group and the Green function for the Hartmann potential.** Vaidya, A.N.; Boschi Filho, H. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21420 (INIS-BR—1424, pp 7) **Christ-Lee model in the sympletic projector approach.** Santos, Marco A. dos; Mello, J.C. de. (Juiz de Fora Univ. (Brazil); Universidade Federal Rural do Rio de Janeiro, RJ (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21421 (INIS-BR—1424, pp 18) **Canonical quantization of the vector superfield.** Barcelos Neto, J.; Braga, N.R.F. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21422 (INIS-BR—1424, pp 19) **Conformally invariant action for N-fibers without the presence of cosmological term.** Alves, M.S.; Barcelos Neto, J. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21423 (INIS-BR—1424, pp 20) **Hamiltonian formulation for chiral bosons without anomalies.** Abdalla, E.; Abdalla, M.C.B.; Devecchi, F.P.; Zadra, A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica; Instituto de Fisica Teorica, Sao Paulo, SP (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21424 (INIS-BR—1424, pp 29) **Spin and paramagnetism in the stochastic classical electrodynamics.** Barranco, A.V.; Brunini, S.A.; Franca, H.M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21425 (INIS-BR—1424, pp 8) **Transposition isomorphysm: new technique of equation system resolution and classification.** Souza, M.M. de. (Espirito Santo Univ., Vitoria (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21426 (INIS-BR—1424, pp 8) **Energy spectrum of quadratic theories of the gravitation.** Maluf, J.W. (Brasilia Univ., DF (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21427 (INIS-BR—1424, pp 9) **Photon number non-conservation in an expansion universe.** Novello, M.; Salim, J.M.; Oliveira, L.A.R. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21428 (INIS-BR—1424, pp 16) **On the constrained functional quantization in a de Sitter universe.** Natividade, C.P. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21429 (INIS-BR—1424, pp 28) **Limit in the CP violation in gravitation from the 1987a supernovae data.** Almeida, L.D.; Matsas, G.E.A.; Natale, A.A. (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705747/JAW. (CONF-8809300—).

From 9. national meeting of particle physics and fields; Caxambu, Brazil (21 Sep 1988).

21430 **(INIS-BR—1441) Proceedings of the 6. National Meeting on Intermediate Energy Physics.** (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). 1986. 227p. (In Portuguese). (CONF-8605361—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88705764/JAW.

From 6. national meeting on intermediate energy physics; Pocos de Caldas, Brazil (5 May 1986).

Several works on nuclear, hadron and quark physics are presented covering both aspects; theoretical and experimental, are presented. Emphasis is given in the intermediate energy region, several MeV centil few GeV. (L.C.).

21431 (INIS-SU—70, pp 47-48) **On the binding energy of n particles in the limit of high dimensions.** Gonsales, A. (Academia de Ciencias de Cuba, La Habana). 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

The values E/sub n/(g) are calculated using the 1/N expansion, where the role of N is played by space d dimensions (E/sub n/ is the ground energy state of a system of n identical spinless particles, g are binding constants). It is shown that in the limit of high dimensions the ground state energy of the system of n identical spinless particles are expressed in a general form in terms of energy of two particles. 4 refs.

21432 **(INIS-SU—70) Experimental and theoretical physics. Collection.** (AN SSSR, Moscow. Fizicheskij Inst.). 1988. 54p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780068/JAW.

Papers were abstracted and indexed individually.

21433 **(INIS-SU—71) Experimental and theoretical. Collection.** (AN SSSR, Moscow. Fizicheskij Inst.). 1988. 50p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780069/JAW.

Papers were abstracted and indexed individually.

21434 **(JINR-E—4-88-291) Faddeev equations with an extra resonance channel in muon catalysis.** Motovilov, A.K.; Kuperin, Yu.A.; Susko, A.A.; Vinitskij, S.I. (Arkhangel'skij Lesotechnicheskij Inst. (USSR); Leningradskij Gosudarstvennyj Univ. (USSR); AN Belorusskoj SSR, Minsk. Inst. Teplo- i Massoobmena). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 28p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706095/JAW.

Submitted to Few-Body Systems.

A three-body model is applied to derive inhomogeneous integral and differential Faddeev equations with energy-dependent potentials. The integral equations are shown to be Fredholm equations. The stricking probability ω/sub s/ is determined in terms of the amplitudes of spherical waves in the asymptotics of the exit-channel wave function. The integral representation for ω/sub s/ is given in terms of the continuum wave functions. To the first Born Approximation for the wave function, this representation yields an explicit expression for ω/sub s/ through the expansion coefficients of the wave function of dtμ of the initial channel. 24 refs.; 7 figs.

21435 **(N—89-14036) Some observations on boundary conditions for numerical conservation laws. Final report.** Kamowitz, D. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Nov 1988. 14p. (NASA-CR—181752; ICASE—88-67; NAS—1.26:181752). NTIS, PC A03/MF A01.

Four choices of outflow boundary conditions are considered for numerical conservation laws. All four methods are stable for linear problems, for which examples are presented where either a boundary layer forms or the numerical scheme, together with the boundary condition, is unstable due to the formation of a reflected shock. A simple heuristic argument is presented for determining the suitability of the boundary condition.

21436 **(NIKHEF-H—88-7) Quantum theory of a massless spinning particle.** Holten, J.W. van. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). May 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706107/JAW.

The classical and quantum mechanics of a free massless pointlike fermion is presented. The action is invariant under local 1-dimensional reparametrizations and supersymmetry, as well as a large set of rigid symmetries, including conformal and chiral symmetries. An infinite set of rigid symmetries is derived starting from the chiral invariance, but only a finite subset does not vanish on shell. The BRST-transformations corresponding to the d=1 local symmetries are constructed and the quantization is performed. Finally, the BRST-cohomology is investigated and the conditions producing the physical states are derived. 12 refs.

21437 **(RAL—88-099) Eddy current seminar. 28-30 March 1988.** Emson, C.R.I. (ed.). (Rutherford Appleton Lab., Chilton (UK)). Nov 1988. 95p. (CONF-8803196—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88706127/JAW.

From Eddy current seminar; Abingdon, UK (28 Mar 1988).

The paper presents the fifth symposium in the series of Eddy Current Seminars, held in Abingdon, 1988. The meeting included a

discussion on three-dimensional eddy current formulations, as well as thirteen contributed papers on computational electromagnetics. Of the thirteen papers, two papers on eddy currents in tokamaks were selected for INIS and indexed separately. (U.K.).

21438 **(SAND—88-1884) Time-discretized moments of a randomly excited uncertain linear oscillator.** Branstetter, L.J. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 416p. NTIS, PC A18/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008318/JAW.

Uncertainty is present in all physical systems to some degree. The effect of uncertainty is to make the analysis of a linear structure nonlinear in nature. In conjunction with this effect, the response of a linear oscillator to Gaussian excitation becomes non-Gaussian when its stiffness is uncertain. For large uncertainties, the response and statistical moments are affected significantly. The objective of this thesis is to investigate the actual (not the approximate) behavior of a simple uncertain system. A single-degree-of-freedom damped linear oscillator having uncertain stiffness, and subjected to stationary mean-zero Gaussian white-noise excitation, is considered. General mathematical relations for a total of twenty-nine different statistical moments involving its response, stiffness, and load are derived, numerically integrated, and verified with simulation. The mathematical relations are based on the law of total probability. The moment equations are derived in both continuous and time-discretized form. The time-discretized versions allow the study of various aspects of step-by-step solution procedures employed by several existing stochastic finite element methods which have been proposed by the author and others. The effect of periodic enforcement of a Gaussian response approximation is isolated. It is shown mathematically that as the integration step size becomes small, the moments computed using such an approximation approach those of a deterministic oscillator having a stiffness equal to the mean of its distribution. 97 refs., 161 figs., 12 tabs.

21439 **(UCID—21637) Temporal scattering and reflection software: User's manual.** McLeod, R.R. (Lawrence Livermore National Lab., CA (USA)). 3 Feb 1989. Contract W-7405-ENG-48. 49p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007690/JAW.

This manual gives complete information on how to use the TSAR electromagnetic analysis software. Included are descriptions of input files, the details of how these files affect the problem, and output data specifications. What is not included is the theory of the finite-difference time-domain (FDTD) algorithm or details of the TSAR implementation of it. This manual assumes that readers are sufficiently familiar with FDTD that they only need the "how to" knowledge presented here. 4 figs., 11 tabs.

21440 **(UCRL—21158) Electromagnetic coupling by a wire through a cavity-backed circular aperture in an infinite screen: Final report, Part B.** Wright, D.B. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 124p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007717/JAW.

The problem of a wire penetrating a circular aperture in an infinite screen and coupling energy into a cavity behind that screen is considered. We formulate an integral equation in terms of the electric field in the aperture. This integral equation is solved using two approximate methods: a zeroth-order approximation valid at low frequencies, and the method of moments. In addition, we introduce an equivalent circuit model to aid in our physical interpretation of the problem. Numerical results for the interior current on the wire and for the equivalent circuit admittance parameters are presented in order to provide a comparison between the two approximations. Inside the cavity, we examine the components of the electric field as a function of position. Finally, the exterior magnetic field far from the aperture is studied as a function of frequency. We examine the relationship between interior resonance features associated with the presence of the cavity and observations of the exterior field. 31 refs., 46 figs., 3 tabs.

21441 **(UNB-FIS—05/88) Mean-field theory for the f/sup 2/-f/sup 3/ Anderson impurity.** Nunes, A.C. (Brasilia Univ., DF (Brazil). Dept. de Fisica). Jun 1988. 19p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705602/JAW.

A uranium impurity whose lovest ionic configurations are f/sup 2/ and F/sup 3/ is considered in a j j - coupling scheme in the limit of zero j.j coupling. A mean field theory to the f/sup 2/-f/sup 3/ Anderson - Coleman Hamiltonian is presented which is found to give useful results for ground state properties over whole range of f - occupations.

21442 **Time-reversal invariance in multiple collisions between coupled masses.** Crawford, F.S. (Physics Department and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *American Journal of Physics;* **57**: No. 4, 333-339(Apr 1989).

The time evolution of two mechanical oscillators coupled by a spring can (but need not) exhibit an instant $t = 2t'$ when the initial conditions at $t = 0$ have been exactly restored. When that is the case, then at $t = t'$ energy and momentum have been exchanged exactly as in an elastic collision between two free particles, and the evolution of the system from $t = t'$ to $2t'$ is related to that from 0 to t' by time-reversal invariance. A similar "simulation of elastic scattering" at $t = t'$ can occur for two free particles coupled via collisions with an intermediary mass that bounces back and forth between the two particles provided the intermediary is left at rest at $t = t'$. Examined here is the time evolution of the exchange of momentum and energy for these two examples, determining the values of the coupling spring constant (or mass value) of the intermediating spring (or mass) needed to simulate single elastic scattering between free particles, and looking at the manifestation of time-reversal invariance.

21443 **Approximate analytic solution of the spectral inverse problem.** Engelke, R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *American Journal of Physics;* **57**: No. 4, 339-344(Apr 1989).

An important problem of nonrelativistic quantum theory is: Given a bound-state energy spectrum, determine the space dependence of a potential function that will produce that spectrum. This is sometimes called the "spectral inverse" problem. Here, by use of the first-order WKB energy quantization condition, an approximate analytic solution of this problem is given for the case of one-dimensional symmetric oscillators and for a class of radial oscillators. This is done by reformulating the WKB quantization condition as an Abel integral equation that relates the quantum number to the potential's space dependence. The resultant integral equation can be solved exactly. The harmonic oscillator and the hydrogen atom problems are used to demonstrate the method. The solution for the case of one-dimensional asymmetric oscillators is also briefly discussed and the Morse oscillator is used as an example. Finally, the history of the spectral inverse problem is reviewed and the conditions necessary for its exact solution are discussed. In particular, the conditions required for the inversion process to be unique are considered.

21444 **Steady-state cellular growth during directional solidification.** Kessler, D.A.; Levine, H. (Department of Physics, University of Michigan, Ann Arbor, Michigan 48109). *Physical Review [Section] A: General Physics;* **39**: No. 6, 3041-3052(15 Mar 1989).

We study cellular structures moving at constant velocity, in a symmetric model of directional solidification. This is done by employing Newton's method to solve a discretized version of the integro-differential equation for the solid-liquid boundary. Our results indicate that there is a continuous band of allowed wavelengths and that there is a generic fold in the solution diagram. This fold provides a maximum allowed wavelength for any given velocity. Also, we argue that the mechanism of microscopic solvability serves to fix the tip shape at fixed wavelength. The implications of our results for wavelength and shape selection are briefly discussed.

21445 **Synchronization of perturbed sine-Gordon soliton oscillators.** Cirillo, M.; Bishop, A.R.; Lomdahl, P.S. (Theoretical Division and Center for Nonlinear Studies, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 7, 4804-4807(1 Mar 1989).

We investigate the dynamics of systems composed of perturbed sine-Gordon soliton oscillators coupled through the boundary conditions. The perturbations are a dc forcing term and linear dissipation. The oscillations maintain their indiviudal frequencies for low values of the coupling parameter. However, for particular values of this parameter, the reflections of the solitons at the boundary give rise to radiation exchange which allows spontaneous synchronization. We analyze our results in the light of recent experiments on long Josephson junction oscillators.

21446 **Evolution of attractors in quasiperiodically forced systems: From quasiperiodic to strange nonchaotic to chaotic.** Ding, M.; Grebogi, C.; Ott, E. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2593-2598(1 Mar 1989).

As a model displaying typical features of two-frequency quasiperiodically forced systems, we discuss the circle map with quasiperiodic coupling. We present numerical and analytical evidence for the existence of strange nonchaotic attractors, and we use examples to illustrate various types of dynamical behavior that can arise in typical quasiperiodically forced systems. We investigate the behavior of the system in the two-dimensional parameter plane of nonlinearity strength versus one of the driving frequencies. We find that the set in this parameter plane for which the system exhibits strange nonchaotic attractors has Cantor-like structure and is enclosed between two critical curves. One of these curves marks the transition from three-frequency quasiperiodic attractors to strange nonchaotic attractors; the other marks the transition from strange nonchaotic attractors to chaotic attractors. This suggests a possible route to chaos in two-frequency quasiperiodically forced systems: (three-frequency quasiperiodicity)→(strange nonchaotic behavior)→(chaos).

21447 **Certain stability type and integrable two-dimensional Hamiltonian systems.** Hioe, F.T. (Department of Physics, St. John Fisher College, Rochester, New York 14618). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2628-2634(1 Mar 1989).

We present the results of applying an analytical method, using a new concept involving a periodic stability around a line of initial values, to two Hamiltonian systems with two degrees of freedom each with several parameters. By requiring the systems to have this type of stability, we have been led to known integrable cases for the systems. For one of the systems, our analysis gives six other cases, two of which turn out to be nonintegrable. The status of the remaining four cases has not been established.

21448 **High-frequency limit of the longitudinal impedance of an array of cavities.** Heifets, S.A.; Kheifets, S.A. (Continuous Electron Beam Accelerator Facility (CEBAF), 12070 Jefferson Avenue, Newport News, Virginia 23606). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 3, 960-970(1 Feb 1989).

The longitudinal impedance of an array of cylindrically symmetric cavities connected by side pipes is estimated in the high-frequency limit. The expression for the impedance is obtained for an arbitrary number of cavities. The transition from the case of a single cavity to a periodic structure is studied. The impedance per cell decreases with frequency ω as ω/sup -1/2/ for a small number of cells. For a large number of cells the impedance decreases as ω/sup -1/2/ or as ω/sup -3/2/ depending on a certain relation between the frequency and the number of cells. The parameter which governs the transition from one regime to the other is found. In particular, for the infinite periodic structure there is only the second regime and the impedance decreases as ω/sup -3/2/ for all frequencies.

21449 **Fine scale thermal blooming instability: a linear stability analysis.** Barnard, J.J. (University of California, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Applied Optics;* **28**: No. 3, 437-445(1 Feb 1989).

The fine-scale thermal blooming instability of a high power trans-atmospheric laser beam is shown to be affected by the laser pulse length. In this study, we calculate the asymptotic gain of a sinusoidal perturbation as a function of pulse length and perturbation wavenumber. We include the effects of viscosity, diffusion, and wind shear, and we heuristically estimate the effect of turbulence. We find that for short laser pulses, the small wavenumber perturbations are reduced due to acoustic effects. However, large wavenumber perturbations remain large and extend to a higher cutoff in wavenumber than in the long laser pulse limit. At wavenumbers higher than this cutoff, thermal diffusion causes exponential decay of the perturbations. For long laser pulse length wind shear and turbulence limit perturbation growth.

21450 **Analogy between Fresnel diffraction and generalized radiance.** Winston, R. (The Enrico Fermi Institute and Department of Physics, The University of Chicago, 5640 Ellis Avenue, Chicago, Illinois 60637). *Journal of the Optical Society of America A: Optics and Image Science;* **6**: No. 1, 145-146(Jan 1989).

An analogy between the generalized radiance from a planar Lambertian source and the Fresnel diffraction amplitude from a plane aperture of the same size and shape as the source is exhibited.

21451 **Numerical prediction of one-dimensional ablation using a finite control volume procedure with exponential differencing.** Blackwell, B.F. (Aerothermodynamics Div. 1553, Sandia National Lab., Albuquerque, NM (US)). *Numerical Heat Transfer;* **14**: No. 1, 17-34(1988).

The exponential differencing scheme of Spalding, which has been used for convection problems, is adapted to solve one-dimensional ablation problems by using a grid attached to the receding surface. Using the finite control volume approach, element conduction, convection, and storage matrices are developed. The method is applied to a steady-state ablation problem for which an analytical solution is known; comparisons are also made with upwind differencing for the convection terms and central differencing for the conduction terms. An example of a realistic ablation problem is presented.

70 FUSION ENERGY

21452 **(UCRL—100194) Fusion: A necessary component of US energy policy.** Correll, D.L. Jr. (Lawrence Livermore National Lab., CA (USA)). 11 Jan 1989. Contract W-7405-ENG-48. 24p. (CONF-890182—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006234/JAW.

From McGraw-Hill nuclear publication's forum on US energy policy and nuclear option; Washington, DC, USA (31 Jan 1989).

US energy policy must ensure that its security, its economy, or its world leadership in technology development are not compromised by failure to meet the nation's electrical energy needs. Increased concerns over the greenhouse effect from fossil-fuel combustion mean that US energy policy must consider how electrical energy dependence on oil and coal can be lessened by conservation, renewable energy sources, and advanced energy options (nuclear fission, solar energy, and thermonuclear fusion). In determining how US energy policy is to respond to these issues, it will be necessary to consider what role each of the three advanced energy options might play, and to determine how these options can complement one another. This paper reviews and comments on the principal US studies and legislation that have addressed fusion since 1980, and then suggests a research, development, and demonstration program that is consistent with the conclusions of those prior authorities and that will allow us to determine how fusion technology can fit into a US energy policy that takes a balanced, long term view of US needs. 17 refs.

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REFER ALSO TO CITATION(S) 21523

21453 **(AERE-R—13136) Final report on JET Contract No. JT7/10880 between JET joint undertaking and Harwell Laboratory on Be-H charge transfer in the JET boundary.** Greenland, P.T. (UKAEA Harwell Lab. Theoretical Physics Div.). May 1988. 47p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705955/JAW.

This report discusses the process Be/sup q+/ + H -> Be/sup (q-1)+/ +p under conditions appropriate to the JET boundary. It provides new calculations and a survey of existing data for the Be/sup 2+/ and Be/sup 4+/ cases, new calculations for Be/sup 3+/ and estimates for the B/sup +/ case. Estimates of the cross section for the resonant charge transfer Be/sup +/ + Be -> Be+Be/sup +/ are also made. Simple formulae which fit the cross sections, and rate coefficients based on these formulae are given.

21454 **(ANL/FPP/TM—235) Maximal bootstrap current tokamak equilibria in the first stability regime.** Ehst, D.A.; Evans, K. Jr. (Argonne National Lab., IL (USA)). Jan 1989. Contract W-31109-ENG-38. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008201/JAW.

A series of tokamak equilibria are studied in order to identify characteristics which may maximize the proportion of toroidal current naturally provided by the bootstrap effect. These plasmas are typical of high field reactors considered by the ARIES [Advanced Reactor Innovation and Evaluation Study] collaboration and are assumed to have rather flat density profiles and broad pressure profiles. With the use of noninductive current drive to provide the seed current it is possible to operate with q/sub axis/ $\cong$ 2.0; this results in a (bootstrap-assissted) current drive power of P/sup B// sub CD/ - 117 MW and a figure of merit /sub gamma//sup B/ = 1.12 for reference reactor with {bar T}/sub e/ $\cong$ 21 keV. For the reference reactor P/sub f/ = 2880 MW so Q = 24. Without the bootstrap effect the absorbed current drive power would be P/sub CD/ = 285 MW, so T {equivalent←to} 1 {minus} (/sub gamma///sub gamma//sup B)/ = 0.59. 10 refs., 9 figs., 2 tabs.

21455 **(CONF-890267—1) Characteristics of the ORNL ECR multipole plasma source.** Berry, L.A.; Gorbatkin, S.M.; Roberto, J.B.; Tsai, C.C.; Holber, W.; Yeh, J. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007564/JAW.

From SRC plasma etch topical research conference; Cambridge, MA, USA (1 Feb 1989).

There are many similarities between the characteristics of the plasma sources needed for semi-conductor processing and those needed for fusion neutral beams. Both need useful plasma areas up to 20-30 cm in diameter and uniform plasma densities (<10% variation for fusion with a factor of about three better needed for semiconductor processing). The evolution of fusion ion sources suggested a development strategy for improved semiconductor processing sources. The first step in this path has now been carried out at ORNL and has produced encouraging results. This progress suggests that this line of development has a good chance of meeting semiconductor processing needs. 2 refs., 5 figs.

21456 **(CONF-890302—6) Fast-wave ion cyclotron current drive for ITER and prospects for near-term proof-of-principle experiments.** Swain, D.W.; Batchelor, D.B.; Carter, M.D.; Jaeger, E.F.; Ryan, P.M.; Hoffman, D.J. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006189/JAW.

From 16. European conference on controlled fusion and plasma physics; Venice, Italy (13 Mar 1989).

Low-frequency fast-wave current drive (FWCD) with frequencies in the range from 30 to 100 MHz looks promising for current drive in ITER. Its theoretical efficiencies are comparable to other current-drive techniques, and it could be significantly cheaper than other proposed current drive methods because of the ready availability of inexpensive (<$1/W), efficient, multi-megawatt rf power sources. The most critical issues for FWCD are concerns about the acceptability and survivability of an appropriate antenna launching system and the lack of an experimental demonstration of FWCD in a large tokamak. We describe an antenna array that is flush with the first wall of ITER and should be able to survive in the plasma environment, present theoretical calculations of FWCD in ITER, and show results from a brief survey of some present-day tokamaks in which it might be possible to carry out FWCD proof-of-principle experiments. 4 refs., 5 figs., 1 tab.

21457 **(CTA-IEAV-NT—07/86) Kinetic theory of plasma : the Lenard-Balescu equation.** Uehara, M.; Sudano, J.P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Jul 1986. 39p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705419/JAW.

The Lenard-Balescu Kinetic equation is derived, following Dupree's method, by proceeding via the BBGKY hierarchy and by using Bogoliubov's ideas. The most important hypotheses for this derivation are discussed. The necessity of a better justification for Bogoliubov's adiabatic hypothesis is emphasized.

21458 **(DOE/ER/53206—11) Theoretical studies of the heating of toroidal plasmas with radiofrequency electromagnetic radiation: Progress report, July 1, 1988--June 30, 1989.** Swanson, D.G.; Wersinger, J.M.; Hanson, J.D. (Auburn Univ., AL (USA). Dept. of Physics). Feb 1989. Contract FG05-85ER53206. 12p. NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89008003/JAW.

This report contains papers of studies made in plasma heating of toroidal plasmas. Some topics discussed are: torsatron design; nonlinear lower hybrid wave effects; physics of ion Bernstein wave heating; plasma waves; and other related topics. (LSP)

21459 **(DOE/ER/53276—1) Colorado School of Mines fusion gamma ray project: Technical progress report.** Cecil, F.E. (Colorado School of Mines, Golden (USA)). 19 Jan 1989. Contract FG02-88ER53276. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007711/JAW.

This report summarizes the technical accomplishments of the first year of a contract between the Colorado School of Mines and the US Department of Energy entitled "Fusion gamma ray diagnostics of alpha particle production and confinement in the Compact Ignition Torus" No. DE-FG02-88ER53276. The stated goals of the contract were to: develop a high count rate gamma ray spectrometry system; install the system on TFTR and carry out measurements of alpha particle production during ICRH d-^{3}He plasmas as benchmarks for similar proposed measurements on CIT; and, assess the feasibility of fusion gamma ray diagnostics of alpha particle confinement. We have completed the first objective, are in the process of implementing the second objective and are making some very preliminary progress in the third. In addition to the above stated goals, we have, in connection with a separate contract with the DOE Office of High Energy and Nuclear Physics, completed gamma ray branching ratio measurements of the p-^{6}Li and p-^{11}B reactions at proton bombarding energies down to 40 keV. These gamma ray branching ratios will provide the basis for gamma ray diagnostics of future "advanced fuel" fusion reactor systems and hence are reported in this progress report.

21460 **(DOE/ET/51013—262) Current profile modification and MHD activity following pellet injection in Alcator C.** Greenwald, M.; Granetz, R.; Petrasso, R.; Terry, J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Dec 1988. Contract AC02-78ET51013. 12p. (PFC/CP—88-4; CONF-8810231—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007654/JAW.

From IAEA technical committee meeting on pellet injection and toroidal confinement; Gut Ising, F.R. Germany (24 Oct 1988).

Pellet fueling experiments on Alcator C focused on the regime of improved energy and particle confinement, where it was observed that transport for the ionic species was reasonably well described by neo-classical theory. Ion energy transport dropped and particle confinement, particularly for impurity species increased

dramatically. These effects have been ascribed to the suppression of ion temperature gradient driven modes ({eta}/sub i/) by the peaked density profile set up by pellet injection. Although radiation by high Z ions was unimportant in these discharges, the accumulation of low Z impurities, principally carbon, had a profound effect on the discharge by peaking the resistivity profile and reducing the current density near the plasma center. One result of this was a modification of sawtooth activity; a lengthening of the period between sawteeth and ultimately their complete suppression. After suppression of the sawteeth, very large amplitude m = 1, n = 1 oscillations were often observed. The appearance of this mode was often correlated with saturation of impurity confinement. We speculate that this mode is a form of the m = 1 ideal mode that has been held responsible for the sawtooth crash. 14 refs., 5 figs.

21461 **(DOE/ET/53088—363) Diffusion in symplectic maps.** Kook, Hyung-tae; Meiss, J.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). 16 Feb 1989. Contract FG05-80ET53088. 25p. (IFSR—363). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008083/JAW.

The characteristic function is used to obtain the diffusion tensor for symplectic maps. At lowest order the quasilinear result is obtained, and a series in higher order correlations is developed. Comparison of the theory to numerical experiments is given using a four-dimensional example of Froeschle. The experiments agree well with the theory for moderately large parameters. Arnol'd diffusion for the 'thick layer' case is discussed. It is shown that the short time correlations in one canonical plane affect the diffusion in the other plane even in the limit of zero coupling. Accelerator modes exist for the Froeschle example, and cause divergences in the diffusion, but these only appear when the accelerating region is included in the ensemble. 17 refs., 5 figs.

21462 **(DOE/ET/53088—364) Short wave electron temperature gradient driven drift wave turbulence.** Bekki, N.; Horton, W.; Hong, B.G.; Tajima, T. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Feb 1989. Contract FG05-80ET53088. 17p. (IFSR—364). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008465/JAW.

A local, hydrodynamic model of the short wavelength electrostatic drift waves driven unstable by the electron temperature gradient in toroidal geometry is used to find the saturation level and the mode coupling to the longer wavelength collisionless skin depth c/ω/sub pe/ magnetic turbulence. We show that the k-spectrum is peaked in the c/ω/sub pe/ wavelength region at the mixing length amplitude. The level of magnetic turbulence is sufficient to produce the empirical neo-Alcator type of confinement formula. 12 refs., 5 figs.

21463 **(FRCEA-TH—135) Design and realization of an NxOD code for the study of electron energy transport in Tokamaks.** Pain, M.S. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Plasmas). Jan 1987. 129p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757005/JAW.

An NxOD code to analyze electron cyclotron heating of the TFR tokamak was developed. An OD code considers the entire physical space as one point: physical dimensions are defined at each instant only at this point, which means assuming that the plasma is homogeneous and uniform. The analysis mode characterizes confinement in relation to experimental data, while the simulation mode is used to follow the evolution of electron and ion temperatures with an imposed transport mechanism, and is designed to test theoretical hypotheses. It was able to quantify energy confinement degradation during heating; to reveal two ohmic confinement regimes depending on current value and leading to the same regime when heating is applied; and to carry out calculations to estimate the interest of an experiment on Tore Supra. The code was also used to test a nonlocal transport hypothesis, with encouraging results, and to verify scale laws, giving results close to those obtained with the MAKOKOT code.

21464 **(FRNC-TH—3349) Microwave reflectometry for the determination of electron density and its fluctuations in the PETULA-B tokamak.** Bottollier-Curtet, H. (Paris-11 Univ., 91 - Orsay (France)). 1986. 184p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88757011/JAW.

Millimeter wave reflectometry was extended to the extraordinary mode to determine electron density and its fluctuations in a tokamak plasma. Profile measurements are made in 200 microsec, which corresponds to the time limit for source scanning, and which could be reduced. The influence of current generation at 1.3 GHz on the density profile is shown. By working at a fixed frequency, density fluctuation information can be obtained, whether the perturbation is in a propagation or a reflection zone. An MHD fluctuation (mode tearing m=2) in the PETULA tokamak is found. The advantages of microwave reflectometry in extraordinary mode compared to normal mode are stressed.

21465 **(FRNC-TH—3350) Small scale electron density fluctuations in a tokamak: statistical aspects and links with magnetohydrodynamic activity.** Gentile, B. de. (Paris-11 Univ., 91 - Orsay (France)). Jan 1987. 145p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88757207/JAW.

The installation and operation of coherent microwave diffusion diagnostics in the TFR tokamak are outlined. The original setup was modified to make diagnostic information accessible to the computer. Microfluctuations were studied using a statistical method. Toroidal propagation of drift waves was assessed using a method of correlation between two diffusion diagnostics. Then, using only one of the diagnostics, statistical analysis tools were employed to evaluate the rate of nonlinear quadratic coupling between three modes. Experimental links between electron density fluctuations and MHD phenomena are demonstrated.

21466 **(GA-A—19535) Fusion programs in applied plasma physics and development and technology: Fiscal Years 1984--1988.** (General Atomics, San Diego, CA (USA)). Mar 1989. Contract AC03-84ER53158. 128p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008653/JAW.

This report contains papers on the following topics in plasma physics: fusion plasma theory, nuclear diagnostics; current density profile diagnostic development; ergodic and resonant magnetic divertor experiments on text; reactor systems design; plasma technologies; and fusion technologies. (LSP)

21467 **(GA-A—19562) Plasma rotation and electric field effects in H-mode in DIII-D.** Groebner, R.J.; Gohil, P.; Burrell, K.H.; Osborne, T.H.; Seraydarian, R.P.; St. John, H. (General Atomics, San Diego, CA (USA)). Jan 1989. Contract AC03-84ER51044. 7p. (CONF-890302—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006917/JAW.

From 16. European conference on controlled fusion and plasma physics; Venice, Italy (13 Mar 1989).

Poloidal rotation has been observed near the separatrix of H-mode discharges in the DIII-D tokamak. This rotation persists throughout the entire time of the H-phase and is a general characteristic of all H-mode discharges studied to date. The force balance equation for a single ion species shows unambiguously that the poloidal rotation is produced by a negative radial electric field. Field strengths of at least 200-300 V/cm have been inferred 1-3 cm inside the separatrix, and the electric field may extend across the separatrix into the scrape-off layer. This paper discusses the techniques used to measure poloidal rotation and the salient features of the rotation. 6 refs., 2 figs.

21468 **(GA-A—19564) H-Mode transition studies in DIII-D.** Carlstrom, T.N.; Shimada, M.; Burrell, K.H.; DeBoo, J.C.; Gohil, P.; Groebner, R.J.; Hsieh, C.; Matsumoto, M.; Trost, P. (General Atomics, San Diego, CA (USA)). 1989. Contract AC03-84ER51044. 7p. (CONF-890302—12). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006913/JAW.

From 16. European conference on controlled fusion and plasma physics; Venice, Italy (13 Mar 1989).

Determining the conditions necessary for the H-transition is important not only for scaling this important confinement regime to future machines but also to aid the understanding of H-mode physics with the hope of further exploiting H-mode confinement. We have done systematic scans of I/sub P/, {bar n}/sub e/, B/sub T/, and the X-point to divertor plate distance δ, in single-null diverted discharges, to ascertain their influence on the threshold power required for the L-H transition. During each of these scans, the neutral beam power (H{degree} → D^+) was increased in a staircase fashion and the power required for the transition was noted. Over the ranges of: 1 < I/sub P/ (MA) < 2, 1 < B/sub T/(T) < 2, 3 < {bar n}/sub e/ (10^{19} m/sup {minus}3/) < 8, and 1 < δ (cm) < 23, the threshold power scales as {bar n}/sub e/B/sub T/, independent of I/sub P/, and is reduced when δ is small. This method also provided an L-mode power scan over the various plasma conditions, in which we looked for changes in the L-mode plasma, particularly in the edge region, that might trigger the H-transition. Over the range of conditions studied, we found that T/sub e/ (r/a = 0.97)/B/sub T/ approached a critical value before each L-H transition. Various theories have been put forth to explain the bifurcation observed at the L-H transition. We show that the prediction of several of these theories are inconsistent with the observations on DIII-D. 16 refs., 2 figs.

21469 **(GA-A—19566) Results from the DIII-D millimeter-wave reflectometer.** Lehecka, T.; Doyle, E.J.; Philipona, R.; Luhmann, N.C. Jr.; Peebles, W.A.; Hsieh, C.L.; Carlstrom, T.N.; Seraydarian, R.P. (General Atomics, San Diego, CA (USA)). Jan 1989. Contract AC03-84ER51044. 6p. (CONF-890302—13). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006912/JAW.

From 16. European conference on controlled fusion and plasma physics; Venice, Italy (13 Mar 1989).

The limited viewing access and asymmetric D-shaped plasmas on DIII-D make millimeter-wave reflectometry an attractive diagnostic for density profile and fluctuation measurements. For a reflectometer the Abel inversion of the phase information is performed along the line of sight, so only a single viewing chord, and no symmetry assumption, is required for density profile measurements. The quantity required for the profile determination is a measure of the propagation delay (phase or time) to the cutoff layer and back, either continuously or at several points on the density profile. In its final form the reflectometer system for DIII-D will be composed of two independent reflectometers; a seven channel narrowband reflectometer for density profile and fluctuation measurements, primarily in the plasma edge region, and a broadband reflectometer for full density profile measurements. Laboratory testing of the broadband system is nearly complete, and we are aiming for installation on DIII-D in early 1989. In this paper we will restrict our attention to some of the results which have been obtained with the narrowband reflectometer. 7 refs., 4 figs.

21470 **(INIS-mf—11368) Electron cyclotron waves, transport and instabilities in hot plasmas.** Westerhof, E. (Rijksuniversiteit Utrecht (Netherlands)). 25 Nov 1987. 179p. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88706066/JAW.

Includes Dutch summary.

A number of topics relevant to the magnetic confinement approach to the thermonuclear fusion is addressed. The absorption and emission of electron cyclotron waves in a thermal plasma with a small population of supra-thermal, streaming electrons is examined and the properties of electron cyclotron waves in a plasma with a pure loss-cone distribution are studied. A report is given on the 1-D transport code simulations that were performed to assist the interpretation of the electron cyclotron heating experiments on the TFR tokamak. Transport code simulations of sawteeth discharges in the T-10 tokamak are discussed in order to compare the predictions of different models for the sawtooth oscillations with the experimental findings. 149 refs.; 69 figs.; 7 tabs.

21471 (INIS-SU—70, pp 41-43) **Multifunctional diagnostic complex for investigating pulsed neutron radiation at plasma focus-type devices.** Klimov, V.M. 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

An automated complex for studying the energy and time distributions of pulsed neutron emission at a plasma focus-type device (FLORA) is developed. Mathematical methods of data processing taking into account a concrete geometry of the experiment are elaborated. 3 refs.; 3 figs.

21472 (INIS-SU—70, pp 9-11) **On the interaction of harmonics in the weakly non-linear stage of instability growth in spherical shells.** Tishkin, V.F.; Fedyanin, A.O.; Lebo, I.G.; Rozanov, V.B. (AN SSSR, Moscow. Inst. Prikladnoj Matematiki). 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

A weak nonlinear stage of development of Rayleigh-Taylor instability in compressible spherical shells is studied. It is shown that interaction of harmonics decreases the rate of perturbation growth and leads to generation of new harmonics. 6 refs.; 3 figs.

21473 (INIS-SU—70, pp 6-8) **To the theory of convective stimulated Mandelstam-Brillouin scattering in a collisional plasma.** Maksimov, A.V.; Silin, V.P. 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

Equations for acoustic perturbations under conditions, when sound is isothermal with respect to electrons and isothermal or adiabatic with respect to ions are derived. The thresholds of convective Mandelstam-Brillouin stimulated scattering with regard to dissipation caused by collisions are presented. 5 refs.

21474 (INIS-SU—70, pp 31-32) **On splitting of natural modes of fast magnetoacoustic wave by a poloidal magnetic field.** Moroz, P.E. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

An equation defining excitation conditions of different eigenmodes in cylindrical plasma at arbitrary radial dependences of plasma density, longitudinal and poloidal magnetic fields is derived. The numerical solution has shown essential and principal differences from the known approximated expressions for splitting of eigenmodes. 4 refs.; 2 figs.

21475 (INIS-SU—70, pp 39-40) **Stimulated ionization scattering in a weakly ionized plasma.** Ignatov, A.M.; Kikvidze, R.R. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1988. (In Russian). NTIS (US Sales Only), PC A04/MF A01; INIS. Order Number DE89780068/JAW.

Kratkie soobshcheniya po fizike.; no. 7.

In Experimental and theoretical physics. Collection.

A linear stage of ionization-field instability caused by dependence of recombination and ionization rates under certain conditions and, consequently, the plasma density on the external electromagnetic field amplitude is considered earlier. The most stable are density perturbations leading to excitation of waves with a frequency close to an incident wave frequency. The paper describes a nonlinear stage of this process, which is called stimulated ionization scattering. 6 refs.

21476 (INIS-SU—71, pp 22-24) **To the theory of the thermal double Mandelshtam-Brillouin stimulated scattering in a plasma.** Maksimov, A.V.; Silin, V.P. 1988. (In Russian). NTIS (US Sales Only), PC A03/MF A01; INIS. Order Number DE89780069/JAW.

Kratkie soobshcheniya po fizike.; no. 4.

In Experimental and theoretical physics. Collection.

Generation of thermal double Mandelstam-Brillouin stimulated scattering in a fully ionized plasma under conditions, when dissipation of excited acoustic waves is defined by ionic viscosity and thermal conduction. 4 refs.

21477 **(INPE—4595) Computer simulation of phenomena in plasma via particles.** Alves, M.V.; Bittencourt, J.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)). Jun 1988. 71p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705539/JAW.

The method of plasma computer simulation via particles has become an efficient tool to investigate the time and spatial evolution of various physical phenomena in plasmas. This method is based on the study of the individual plasma particle motions interacting with one another and with the externally applied fields. Although fairly simple, it allows a non-linear analysis of complex plasma physical phenomena and to obtain diagnostics even for regions of the system where experimental measurements would be difficult to make. In this report, a general view of the electrostatic one-dimensional computer code ES1, originally developed by A. Bruce Langdon, is presented. The main mathematical artifice in this code is the use of a spatial grid in which various plasma particles are represented by "superparticles", using a given shape function. The principal characteristics of the model, the approximations made and the mathematical methods used to solve the equations involved, are described. The specification of the input parameters which characterize the system, the initial conditions and the graphic diagnostics which can be utilized, are also described. Results are presented illustrating graphically the behavior of the plasma oscillations, the two-stream instability and the beam-plasma instability.

21478 **(IPPJ—861) Summary report on the Japan-US workshop on the assessment of spectroscopic data for temperature and density measurements.** Wiese, W.L. (National Bureau of Standards, Gaithersburg, MD (USA)); Fujita, J. (eds.). (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1988. 48p. (CONF-8703133—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756891/JAW.

From US/Japan workshop on assessment of spectroscopic data for temperature and density measurements; Nagoya, Japan (17 Mar 1987).

This workshop was held as a part of the US-Japan Cooperative Fusion Program 1986 at the Institute of Plasma Physics, Nagoya University, on March 18 - 20, 1987. Talks were carried out on the following plasma diagnostic subjects, giving special consideration to the situation of spectroscopic data and the needs, availability and adequacy of the data: x-ray spectroscopy, VUV and visible region spectroscopy, plasma edge spectroscopy, polarization spectroscopy, charge exchange spectroscopy, excitation rate data, and spectral radiometry and spectroscopic data tables. The program of the workshop and the abstracts of the talks are given in the first part of this summary report. On the last day of the workshop, small groups were formed, which deliberated on the situation of spectroscopic data in the various diagnostic areas, and especially focused on the further needs of the data. The summary of the findings and recommendation are given in the second part. The workshop was attended by five US and 25 Japanese scientists, and greatly benefitted from the active participation of three quests. (Kako, I.).

21479 **(IPPJ—862) Adventures in magnetohydrodynamics.** Johnson, J.L. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1988. 73p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756892/JAW.

This material was presented in a set of three lectures on October 29 and 30, 1987 at Nagoya University. It was attempted to give an elementary survey of magnetohydrodynamic theory as it applies to toroidal confinement, emphasizing the concept and avoiding the detailed derivation, in hopes that the ideas will be useful for students and researchers just entering the field. In some places, the actual development should be described, so it was decided that it would be worthwhile to give some exact results. Thus the notes are uneven. The author hopes that everyone who looks at this will find something of interest. By a proper breakdown, this lecture consists of four sections: the section on the derivation and justification of the MHD equations, that on the equilibrium problem, that on linearized stability and some comments on nonlinear evolution, magnetic islands and transport. There is still the work to be done with these simple models. The move into some branch of plasma simulation or drift orbit formulation may be done, but this area is worth to spend a professional life, as the tasks are challenging, and the results are satisfying. (Kako, I.) 61 refs.

21480 **(IPPJ—863, pp 13-33) Nonlinear evolution of free-boundary mode in a tokamak.** Kurita, Gen-ichi; Takizuka, Tomonori; Azumi, Masafumi; Takeda, Tatsuoki. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). Mar 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE89780049/JAW. (CONF-8703311—).

From 2. U.S.-Japan workshop on advanced plasma modeling; Nagoya, Japan (23 Mar 1987).

Nonlinear MHD calculations of the m/n = 2/1 free-boundary mode including tearing mode in a cylindrical tokamak are carried out by taking account of the parallel diffusion of resistivity. When 1.75 < q/sub a/ ≦ 1.9 for q0/q/sub a/ = 0.5 (q0 is the safety factor at the magnetic axis and q/sub a/ is that at the plasma surface), the plasma column shrinks with the elliptic deformation, the value of q/sub a/ is decreased in time, the plasma becomes stable against the m/n = 2/1 mode, and finally damping oscillation is observed. The vacuum bubbles inside the plasma are formed for 1.9 ≦ q/sub a/ < 2. due to free-boundary kink mode and for 2.0 ≦ q/sub a/ ≦ 2.25 due to surface tearing mode, respectively. The saturation of magnetic islands are observed for 2.25 ≦ q/sub a/ ≦ 2.4 due to surface tearing mode with plasma expansion and for higher q/sub a/ values due to usual tearing mode with fixed plasma surface position, respectively. Interaction between the plasma and material limiter causes the shrinkage for all the unstable values of q/sub a/ to free-boundary mode. When q0 is nearly equal to or larger than unity, the plasma shrinks rapidly and q/sub a/ can be reduced less than unity below which the m/n = 1/1 kink mode becomes unstable. This plasma shrinkage is a candidate of the major disruptions in the tokamak discharge with q/sub a/ around 2.

21481 **(IPPJ—883) Potential formation in an RF-plugged axisymmetric mirror-cusp device.** Adati, K.; Kumazawa, R.; Fujita, H. and others. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756893/JAW.

Two experiments are described: (1) the first measurements of enhanced RF electric field at the RF plug section and resulting formation of the RF plug potential, (2) the mechanism of the plasma potential formation in the central section.

21482 **(IPPJ—885) Trapping and acceleration of electron by elliptically polarized electromagnetic wave propagating across static magnetic field.** Takeuchi, Satoshi. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756894/JAW.

Suppose that an electromagnetic wave propagating across a magnetic field B/sub 0/ polarizes on a plane perpendicular to B/sub 0/ and that its phase velocity is a little slower than the light velocity c. It is shown that such wave (EP-wave) can trap a charged particle and accelerate it unlimitedly. The well-known electrostatic and electromagnetic wave trapping accelerations are included as two limiting cases of this acceleration. A brief comment on how to create a slow wave by using a plasma is also presented.

21483 **(IPPJ—886) Power absorption and confinement studies of ICRF-heated plasma in JIPP T-IIU tokamak.** Ida, K.; Ogawa, Y.; Toi, K. and others. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756895/JAW.

The energy confinement characteristics of ICRF-heated tokamak plasmas are studied at high input power density {similar←to} 2 MWm/sup -3/ volume averaged, on the JIPP T-IIU device(R = 0.91 m/a = 0.23 m). High electron and ion temperatures (T/sub e/ {similar←to} 2.5 keV, T/sub i/ {similar←to} 2.0 keV, at each maximum) have been achieved by the operation at

a plasma current I/sub P/ of 280 kA, plasma line-averaged electron density n-bar/sub e/ of 7 x 10/sup 13/ cm/sup -3/ and input power of 2 MW, with a suppression of total radiation loss (30 to 40 % of the total input power) by a carbon coating on the vacuum vessel. The fraction of ICRF power absorbed by the plasma, α, is determined experimentally from the decay of the stored plasma energy just after the ICRF pulse is terminated. The value of α increases slightly with increasing electron density and decreases from 90 to 70 % as the ICRF power is increased from 1 MWm/sup -3/ to 2 MWm/sup -3/ volume averaged. The global energy confinement time tau/sub E/, defined by W/sub P//(P/sub OH/ + αP/sub rf/), decreases by a factor of 2 {similar←to} 3 from that in ohmic plasmas as the heating power increases up to 2 MW. It is found that the energy confinement time has a strong line-averaged electron density dependence as tau/sub E/proportional to n-bar/sub e//sup 0.6/, which is obtained by the use of the measured absorbed power, while the Kaye-Goldston scaling predicts tau/sub E/proportional to n-bar/sub e//sup 0.26/.

21484 **(IPPJ—887) Comparison between Uramoto type and straight filament type sheet plasma as a volume produced H/sup -/ ion source, (2).** Uramoto, Joshin. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756896/JAW.

Each dependence of a H/sup -/ ion current on distance (from 3.5 cm to 17 cm) between a sheet plasma center and the first H/sup -/ ion extraction electrode, is investigated for a straight filament type or a Uramoto type sheet plasma. For the straight filament type, the H/sup -/ ion current increases initially with the distance and decreases after a maximum. On the other hand, for the Uramoto type, the H/sup -/ ion current increases with the distance. Over all the distance, the maximum current of the Uramoto type is about 10 times larger than that of the straight filament type. As a reason for this result, we point out a character that the plasma density and the decay time of negatively charged particles in the Uramoto type sheet plasma, hardly decrease even in the long distance which may be necessary for vibrationally excited H/sub 2/* molecules.

21485 **(IPPJ—888) Space and time resolved measurements of ion temperature with the CVI 5292 A charge exchange recombination line after subtracting background radiation.** Ida, K.; Hidekuma, S. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756897/JAW.

An ion temperature profile has been obtained with the CVI 5292 A (n = 8 - 7) charge exchange recombination (CXR) line using a space and wave-length resolving visible spectrometer installed on the JIPP TII-U tokamak. Two sets of 50 channels optical fiber arrays: one viewing a fast neutral hydrogen beam (CXR channels) and the other viewing off the neutral beam line (background channels), is arranged on the entrance slit of the spectrometer. This spectrometer is coupled to an image intensifier and CCD detector at the focal plane and provides temperature profile every 1/60 second. An ion temperature is derived from the Doppler broadened line profile after subtracting the simultaneously measured cold component (background channels), which is due to electron-excitation and/or charge exchange recombination in the plasma periphery. Alternative approach to obtain the ion temperature profile without CXR is also demonstrated. This method is based on an Abel inversion technique for each wavelength separately.

21486 **(IPPJ—889) Optimization of bootstrap current in a large helical system with L = 2.** Nakajima, N.; Okamoto, M.; Todoroki, J.; Nakamura, Y.; Wakatani, M. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1988. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756898/JAW.

Neoclassical bootstrap currents in the banana and plateau regions are evaluated for an L = 2 large helical system with the major radius of 5 m. Various vacuum magnetic field configurations are invoked to optimize the bootstrap current. In the banana region shifting the magnetic axis and shaping magnetic surfaces have remarkable effects on the bootstrap current and it is clarified that a small outward shift of the magnetic axis and vertically elongated magnetic surfaces are favourable to reduce the bootstrap current. On the contrary, the bootstrap current in the plateau region depends strongly on the toroidal pitch number of helical winding coils but shifting the axis and shaping magnetic surfaces are not effective. The magnitude of bootstrap current is estimated for plasmas in the large helical system predicted by a one dimensional transport code.

21487 **(IPPJ—890) Sheath and presheath in a collisionless open field plasma.** Sato, Kunihiro; Miyawaki, Fujio; Fukui, Wakumi. (Himeji Inst. of Tech., Hyogo (Japan)). (Nagoya Univ. (Japan). Inst. of Plasma Physics). Sep 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756899/JAW.

The plasma-sheath equation for a collisionless plasma with a finite-temperature particle source in a nonuniform open magnetic field is formulated. The analytic solution of this equation is obtained from the quasi-neutral approximation for the plasma outside the sheath. The potential formed in the plasma depends on the profile of the magnetic field strength; potential drop in the plasma region increases and the ion distribution function becomes wider as the magnetic field strength decreases in the direction of the plasma flow. Application of the generalized Bohm criterion shows that the solution of the plasma equation always satisfies this criterion when the magnetic field monotonically decreases in the outside direction. Comparison of the analytic solution with the numerical results of the plasma-sheath equation confirms that over the whole region except the sheath the analytic solution for various profiles of the magnetic field agrees well with the numerical results when the Debye length is sufficiently small.

21488 **(IPPJ—891) Density fluctuations and particle/thermal transport for ohmically and auxiliarily heated plasmas in the JIPP T-IIU tokamak.** Kawahata, K.; Adati, K.; Akiyama, R. and others. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Oct 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756900/JAW.

This paper reports the study of the microturbulence excited in ohmically heated (OH) and auxiliarily heated plasmas in the JIPP T-IIU tokamak. In high density OH plasmas, it has been found that the energy confinement time deviates from the Alcator scaling and at the same time the ion mode which propagates in the ion diamagnetic drift direction is excited in addition to the electron mode. The value of eta/sub i/ = (dlnT/sub i//dlnn/sub i/) evaluated experimentally is about 1.0 - 1.2 when the ion mode is excited. In high power auxiliarily heated plasmas where the ion mode is also observed, the ion thermal diffusivity around r/a $\simeq$ 0.5 is 2 - 5 times larger than the neoclassical values. From the analysis of time evolution of the density profile after the injection of an ice pellet, the particle diffusivity D and the convective velocity v are estimated to be D = 0.4 - 0.7 m/sup 2//s and v = 4 - 8 m/s at r/a $\simeq$ 0.5 for OH plasmas.

21489 **(JAERI-M—88-163) Two-dimensional disruption thermal analysis code DREAM.** Yamazaki, Seiichiro; Kobayashi, Takeshi; Seki, Masahiro. (Kawasaki Heavy Industries, Ltd., Kobe (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 101p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756902/JAW.

When a plasma disruption takes place in a tokamak type fusion reactor, plasma facing components such as first wall and divertor/limiter are subjected to an intense heat load with very high heat flux and short duration. At the surface of the wall, temperature rapidly rises, and melting and evaporation occurs, it causes reduction of wall thickness and crack initiation/propagation. As lifetime of the components is significantly affected by them, the transient analysis in consideration of phase changes (melting/evaporation) and radiation heat loss is required in the design of these components. This paper describes the computer code DREAM developed to perform the two-dimensional transient thermal analysis that takes phase changes and radiation into account. The input and output of the code and a sample analysis on a disruption simulation experiment are also reported. The user's input manual is added as an appendix. The profiles and time variations of temperature, and

melting and evaporated thicknesses of the material subjected to intense heat load can be obtained, using this computer code. This code also gives the temperature data for elastoplastic analysis with FEM structural analysis codes (ADINA, MARC, etc.) to evaluate the thermal stress and crack propagation behavior within the wall materials.

21490 **(JAERI-M—88-207) MHD equilibrium calculations specifying current sources.** Tokuda, Shinji; Takeda, Tatsuoki; Okamoto, Masao. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756919/JAW.

A MHD equilibrium code in which current sources are specified instead of toroidal field function or safety factor has been developed. This code is appropriate to self-consistent analysis of neoclassical current effects (bootstrap current and neoclassical conductivity) in the plasma sustained by the ohmic current. The code can be also applied to equilibrium and stability analysis of tokamak plasmas with non-ohmic currents driven by external sources (NBI/RF-wave) and with neoclassical current effects.

21491 **(JAERI-M—88-216) Self-consistent calculations of neoclassical current effects in JFT-2M tokamak plasmas.** Tokuda, Shinji; Takeda, Tatsuoki; Okamoto, Masao. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756923/JAW.

MHD equilibria of JFT-2M tokamak plasmas with neoclassical bootstrap current and neoclassical conductivity including trapped electrons are studied self-consistently. It is found that the bootstrap current increases proportionally to poloidal beta, β/sub J/, with the coefficient depending weakly on the density and temperature profiles under the condition that most of the plasma column are in the banana regime. Therefore bootstrap current flow little for L-mode type equilibria because of low attainable values of β/sub J/. H-mode type equilibria produce bootstrap currents as large as 30 % of ohmic current for β/sub J/ achieved by JFT-2M and 100 % for β/sub J/ $\geqq$ 1.5, both of which are sufficient to change the current profiles significantly. Neoclassical conductivity which is reduced to a half of classical Spitzer conductivity due to trapped electrons brings a peaked ohmic current profile, yielding low safety factor at the magnetic axis.

21492 **(JET-R—88-08) Thomson scattering diagnostic to measure fast ion and α-particle distributions in JET.** Costley, A.E.; Hoekzema, J.A.; Stott, P.E.; Watkins, M.L.; Hughes, T.P. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking; Essex Univ., Colchester (UK)). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1988. 113p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706092/JAW.

The paper presents the findings of a feasibility investigation into the proposed Thomson scattering diagnostic to measure fast ion and α-particle distributions in JET. A description is given of the motivation for alpha particle diagnostics on JET, followed by a brief survey of possible α-particle diagnostics for JET. The basic principles of the collective Thomson scattering technique are presented, along with its implementation on JET. The expected performance of the system, and other applications of the diagnostic system are also discussed. (U.K.).

21493 **(LBL—26532) An overview of heavy ion drivers for ICF [inertial confinement fusion].** Lee, E.P. (Lawrence Berkeley Lab., CA (USA)). Nov 1987. Contract AC03-76SF00098. 19p. (CONF-871173—6). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007661/JAW.

From 3. ICF system and applications colloquium; Madison, WI, USA (9 Nov 1987).

An overview of conceptual Heavy Ion Induction Linac Drivers for commercial ICF is given. Emphasis is placed on models, issues and scale relations. 14 refs., 1 tab.

21494 **(MATT—1-Suppl.18) Bibliography of Princeton Plasma Physics Laboratory reports covering period January 1, 1988--December 31, 1988.** (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1989. Contract AC02-76CH03073. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008097/JAW.

This report contains a list of the plasma physics reports done at the Princeton Plasma Physics Laboratory. (LSP)

21495 **(PPPL—2597) On resonant excitations of high-n magnetohydrodynamic modes by energetic/alpha particles in tokamaks.** Chen, Liu. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1989. Contract AC02-76CH03073. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008313/JAW.

Analytical theories for the excitations in tokamaks of magnetohydrodynamic (MHD) modes with large toroidal mode numbers ($n>>1$) are presented. Specifically, only instability mechanisms due to resonances with energetic ions/alpha particles are considered. It is noted that, while trapped energetic particles contribute to the ideal region, circulating energetic particles contribute mainly to the singular layer dynamics. A unified dispersion relation manifesting both fishbone-like modes and beam transit-resonance modes is then driven. Finally, we also analyze the stability property of toroidicity-induced shear Alfven waves excited via transit resonances with alpha particles in ignited tokamaks. 11 refs.

21496 **(PPPL-Q—45) Princeton Plasma Physics Laboratory: Annual report, October 1, 1986--September 30, 1987.** (Princeton Univ., NJ (USA). Plasma Physics Lab.). [1987]. Contract AC02-76CH03073. 146p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008659/JAW.

This report contains papers on the following topics: Principle Parameters Achieved in Experimental Devices (FY87); Tokamak Fusion Test Reactor; Princeton Beta Experiment-Modification; S-1 Spheromak; Current-Drive Experiment; X-Ray Laser Studies; Theoretical Division; Tokamak Modeling; Compact Ignition Tokamak; Engineering Department; Project Planning and Safety Office; Quality Assurance and Reliability; Administrative Operations; and PPPL Patent Invention Disclosures (FY87).

21497 (RAL—88-099, pp 42-48) **Calculation of time dependent eddy currents in tokamaks.** Evans, G.A.; Smith, R. (Loughborough Univ. of Technology (UK). Dept. of Mathematics). Nov 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88706127/JAW. (CONF-8803196—).

From Eddy current seminar; Abingdon, UK (28 Mar 1988).

In this paper the numerical calculation of eddy currents has attracted much attention, and approaches and methods have been reviewed. Large eddy currents due to plasma disruption in a fusion reactor tokamak have been calculated using a finite difference approach to the T - Ω formulation. The programme uses a data structure to allow for variable grid sizes and unusual boundary shapes. Linear and exponential plasma disruptions are considered.

21498 (RAL—88-099, pp 60-67) **3D eddy-current distribution in a tokamak first wall during a plasma disruption using "TRIFOU".** Chaussecourte, P.; Bossavit, A.; Verite, J.C.; Crutzen, Y.R. (Electricite de France, 92 - Clamart. Direction des Etudes et Recherches; Commission of the European Communities, Ispra (Italy). Joint Research Centre). Nov 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88706127/JAW. (CONF-8803196—).

From Eddy current seminar; Abingdon, UK (28 Mar 1988).

We report the use of the 3D general purpose eddy current code "TRIFOU" in the context of a specific application in fusion technology. We discuss also what possibilities 3D numerical simulations can bring into this specific area. After a short description of the computer program formulation and a short presentation of the code architecture, we illustrate some results, in particular eddy current distributions, in a complex 3D non-magnetic conductor: a first wall module of NET (Next European Torus).

21499 **(Rijnhuizen—88-177) Stability of a Taylor-relaxed cylindrical plasma separated from the wall by a vacuum layer.** Schuurman, W.; Weenink, M.P.H.; EURATOM - FOM - Technische Univ. Twente Collaboration. (FOM-Instituut voor Plasmafysica, Rijnhuizen (Netherlands); European Atomic Energy Society; FOM-Instituut voor Plasmafysica, Rijnhuizen (Netherlands); European Atomic Energy Society; Technische Univ. Twente, Enschede (Netherlands)). (FOM-Instituut voor Plasmafysica, Rijnhuizen (Netherlands)). Jul 1988. 42p. Library, KNAW; P.O. Box 41950, 1009 DD Amsterdam (NL).

The minimum energy principle of Taylor is extended to the case where a vacuum layer is situated between the weakly resistive plasma and the perfectly conducting wall. The second variation is investigated for periodic perturbations (m and/or knot =0) as well as for symmetric perturbations (m=k=0). A necessary and sufficient criterion for stability is derived by means of the Rayleigh ratio method and turns out to be identical with the result of the resistive mode analysis. Stability diagrams λ vs k are presented. A new instability region at m=1 is found at negative values of k, already present when λ is small. The symmetric mode becomes more unstable as the vacuum layer grows thicker. 11 refs.; 7 figs.; 92 schemes.

21500 **(UCID—17530-89-Rev.8) The Computational Physics Program of the national MFE Computer Center.** Mirin, A.A. (Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 63p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008643/JAW.

Since June 1974, the MFE Computer Center has been engaged in a significant computational physics effort. The principal objective of the Computational Physics Group is to develop advanced numerical models for the investigation of plasma phenomena and the simulation of present and future magnetic confinement devices. Another major objective of the group is to develop efficient algorithms and programming techniques for current and future generations of supercomputers. The Computational Physics Group has been involved in several areas of fusion research. One main area is the application of Fokker-Planck/quasilinear codes to tokamaks. Another major area is the investigation of resistive magnetohydrodynamics in three dimensions, with applications to tokamaks and compact toroids. A third area is the investigation of kinetic instabilities using a 3-D particle code; this work is often coupled with the task of numerically generating equilibria which model experimental devices. Ways to apply statistical closure approximations to study tokamak-edge plasma turbulence have been under examination, with the hope of being able to explain anomalous transport. Also, we are collaborating in an international effort to evaluate fully three-dimensional linear stability of toroidal devices. In addition to these computational physics studies, the group has developed a number of linear systems solvers for general classes of physics problems and has been making a major effort at ascertaining how to efficiently utilize multiprocessor computers. A summary of these programs are included in this paper. 6 tabs.

21501 **Flashboards as a plasma source for plasma opening switch applications.** Renk, T.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **65**: No. 7, 2652-2663(1 Apr 1989).

A plasma opening switch (POS) requires the use of a source to inject plasma, usually into the vacuum section of a transmission line of a pulsed power generator. The injection point is typically just upstream of the generator load. A flashboard, which consists of a network of flashover gaps built into a stripline geometry, is capable of providing the drifting plasma source used in the POS. This paper details a series of measurements aimed at optimizing this source plasma in order to obtain improved performance of the combination POS-load system.

21502 **Electron heat transport in a steep temperature gradient.** Rogers, J.H.; De Groot, J.S.; Abou-Assaleh, Z.; Matte, J.P.; Johnston, T.W.; Rosen, M.D. (Department of Applied Science, University of California Davis, Davis, California 95616). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 741-749(Apr 1989).

Temporal and spatial measurements of electron heat transport are made in the University of California Davis AURORA device (J. H. Rogers, Ph.D. dissertation, University of California, Davis, 1987). In AURORA, a microwave pulse heats a region of underdense, collisional, plasma (n/n/sub cr/ approx. <1, where n/sub cr/ = 1.8 x 10/sup 10/ cm^{-3} is the critical density, T/sub e/≅0.15 eV, and the electron scattering mean free path λ/sub perpendicular/approx. >2 cm). In this region, strong thermal heating (T/sub c/ approx. <0.7 eV) as well as suprathermal heating (T/sub h/ ≅3 eV) is observed. The strong heating results in a steep temperature gradient that violates the approximations of classical heat diffusion theory (L/sub T//λ/sub perpendicular/approx. >3 for thermal electrons, where L/sub T/ = T/sub c/(partialT/sub c//partialz)$^{-1}$ is the cold electron temperature scale length. The time evolution of the electron temperature profile is measured using Langmuir probes. The measured relaxation of the temperature gradient after the microwave pulse is compared to calculations using the Fokker—Planck International code [Phys. Rev. Lett. 49, 1936 (1982)] and the multigroup, flux-limited, target design code LASNEX [Comm. Plasma Phys. 2, 51 (1975)]. The electron distribution function at the end of the microwave pulse is used as initial conditions for both codes. The Fokker—Planck calculations are found to agree very well with the measurements.

21503 **Fusion-product spectral linewidth in D-D, D-T, and ^{3}He-D plasmas as an ion speed-distribution diagnostic.** Slaughter, D.R. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **60**: No. 4, 552-561(Apr 1989).

A Monte Carlo simulation has been used to study the fusion-product spectral line shape in high-temperature thermonuclear and beam-driven plasmas in order to determine whether line-shape measurements are a viable technique to determine the reacting ion speed distribution and its mean energy. Specific reactions considered include D(d,n), T(d,n), and ^{3}He(d,p). Several speed distributions characteristic of "mirror-confined" and beam-driven plasmas were assumed, including Maxwellian, monoenergetic, three-component Gaussian (characteristic of injected neutrals), and an injected beam reacting with Maxwellian targets. Mean energies in these distributions were varied over the range 1—100 keV. Results indicate that symmetrical Gaussian spectral lines are generated for isotropic plasmas regardless of ion energy or speed-distribution form. However, the location and width of the Gaussian depends not only on the mean ion energy, but also on the form of the ion speed distribution and its angular distribution. Generally, the linewidth is proportional to the square root of the mean ion energy, but the proportionality constant varies significantly among the speed and angular distributions considered. Thus the angular distribution and functional form of the reacting ion speed distribution must be known before measured Doppler width in the product spectrum may be used to infer the mean ion energy of the reacting plasma.

21504 **Four-channel ZnS scintillator measurements of escaping tritons in TFTR.** Zweben, S.J. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **60**: No. 4, 576-587(Apr 1989).

A four-channel scintillation detector capable of measuring tritons, protons, and alphas escaping from a tokamak plasma was operated during the 1986 run period of the Tokamak Fusion Test Reactor (TFTR). Signals consistent with the expected 1-MeV triton behavior have been observed during deuterium operation. Backgrounds associated with neutrons/gammas and soft x rays have been evaluated in situ and are shown to be at the ≅10%—20% level for the present detector. Such a detector is capable of measuring escaping alphas in deuterium-tritium-fueled tokamaks such as TFTR.

21505 **Unified theory of tokamak transport via the generalized Balescu—Lenard collision operator.** Mynick, H.E.; Duvall, R.E. (Plasma Physics Laboratory, Princeton University, P. O. Box 451, Princeton, New Jersey 08543-0451). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 750-765(Apr 1989).

A unified basis from which to study the transport of tokamaks at low collisionality is provided by specializing the "generalized Balescu—Lenard" collision operator to toroidal geometry. Explicitly evaluating this operator, ripple, turbulent, and neoclassical transport coefficients are obtained, simply by further specializing the single operator to different particular classes of fluctuation wavelength and mode structure. For each class of fluctuations, the operator possesses a diffusive, test-particle contribution D, and in addition a dynamic drag term F, which makes the operator self-consistent, and whose presence is accordingly essential for the resultant fluxes to possess the appropriate conservation laws and symmetries. These properties, well known for axisymmetric transport, are demonstrated for one type of turbulent transport, chosen for definiteness, by explicit evaluation of both the "anomalous diffusion" term arising from D, as well as the closely related "anomalous pinch" term coming from F. The latter term is neglected by test-particle calculations, but is shown to have an important impact on the predicted fluxes.

21506 **Toroidal studies of sawtooth oscillations in tokamaks.** Aydemir, A.Y.; Wiley, J.C.; Ross, D.W. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 774-787(Apr 1989).

Tokamak sawtooth oscillations are studied with a nonreduced, fully toroidal, resistive magnetohydrodynamic (MHD) model that includes Ohmic heating, and parallel and perpendicular thermal conductions. Effects of perpendicular transport in producing different types of sawteeth, varying from simple, periodic oscillations to giant sawteeth with temperature modulations of order unity, and compound sawteeth with multiple relaxations, are demonstrated. Some of the recent experimental observations from large tokamaks, such as the fast crash times and a presumed topological anomaly in the x-ray tomography pictures, thought to be inconsistent with the Kadomtsev reconnection model, are examined and possible explanations are offered.

21507 **Magnetohydrodynamic stability and nonlinear evolution of the m = 1 mode in toroidal geometry for safety factor profiles with an inflection point.** Holmes, J.A.; Carreras, B.A.; Charlton, L.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 788-797(Apr 1989).

Magnetohydrodynamic (MHD) stability and nonlinear evolution of the m = 1 mode are studied in toroidal geometry for safety factor profiles having an inflection point at the q = 1 surface. For ideally stable cases, linear growth rates of the resistive m = 1 mode are decreased by any combination of the following variations: decreasing the aspect ratio, decreasing shear at the q = 1 surface, increasing S, decreasing q_0, and/or decreasing beta. Transitions from resistive kink to tearing mode to complete stability are accompanied by increasing localization as the mode is stabilized. The ideal stability of the m = 1 mode for low-shear inflection-point profiles is broken at very low, but finite, beta by the appearance of a radially localized ideal interchange mode. As beta is increased, the m = 1 mode becomes a global ideal internal kink. These ideal modes are stabilized by decreasing the aspect ratio and, to a lesser extent, by increasing shear at the q = 1 surface. Nonlinear evolution of the m = 1 mode is found to follow the Kadomtsev complete reconnection process or to be stable, depending on the linear stability of the mode. However, all nonlinear calculations were carried out at Lundquist number $S = 10^5$ and hence contain substantial resistive kink contributions. Consequently, nonlinear evolution in the m = 1 tearing mode regime is not examined. Even for cases in which ideal effects dominate the linear mode, Kadomtsev reconnection is observed. The nonlinear stability of linearly stable modes was also uniformly observed, even for several cases having large initial perturbations.

21508 **Resistive "infernal" modes.** Charlton, L.A.; Hastie, R.J.; Hender, T.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 798-803(Apr 1989).

Resistive "infernal" modes are considered that are just below the ideal internal mode threshold. Nearest the ideal threshold, a resistive continuation of the ideal infernal mode, whose growth rate scales as eta^3/sup //^{13} (eta being the resistivity), is seen. Farther away is the conventional tearing mode with a eta^3/sup //^{5} scaling. These scalings are found both numerically and analytically.

21509 **Quenching of external kink modes by localized radio-frequency fields.** D'Ippolito, D.A.; Goedbloed, J.P. (Lodestar Research Corporation, 2400 Central Avenue, Boulder, Colorado 80301). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 804-814(Apr 1989).

The quenching of external kink modes by a spatially localized, externally applied surface force is studied in a low-beta cylindrical tokamak model. It is shown that m = 2 modes may be stabilized by the application of a radio frequency (rf) field in the ion cyclotron range of frequencies (ICRF) excited by either a toroidal or a poloidal antenna structure surrounding the plasma. Whereas linear mode coupling induced by toroidal localization is negligible, that caused by poloidal localization may degrade the stabilization and, thus, require increased power levels for stability. The model is directly applicable to the ponderomotive force exerted by an evanescent slow wave in the ion cyclotron range of frequencies. Quantitative estimates are made for ponderomotive stabilization of kink modes by means of ion-Bernstein-wave (IBW) antennas. This method of stabilization has the advantage that the antenna system does not have to match the spatial or temporal structure of the unstable modes. For typical IBW antenna systems, it is found that the required rf fields for kink stabilization are reasonable if the current profile is not too flat.

21510 **Stability thresholds of a disk-shaped Migma.** Wong, H.V.; Rosenbluth, M.N.; Berk, H.L. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 826-839(Apr 1989).

The stability of a Migma disk is reexamined to determine the threshold to the interchange instability. It is shown that a previous calculation [Z. Naturforsch. Teil A 42, 1208 (1987)], which assumes a rigid mode eigenfunction, is inaccurate at the predicted particle number for marginal stability. As a result the integral equation for the system must be solved. A variational method of solution is developed and is shown to give good agreement with a direct numerical solution. The threshold for instability is found to be sensitive to the details of the distribution function. For highly focused systems, where all ions pass close to the axis, the threshold particle number (N/sub u/$_1$) for instability is substantially below that predicted by rigid mode theory (N/sub rigid/) (by a factor $\sim 8\epsilon^2$, where $\epsilon = r_1/$ r/sub L/, r_1 is the spread in the distance of closest approach to the axis, and r/sub L/ the ion Larmor radius). At a higher density, a second band of stability appears that again destabilizes at yet a higher particle number (N/sub u/$_2$). If $\epsilon << 1$, N/sub u/$_2$ is substantially below the rigid mode prediction, while for $0.2 < \epsilon < 0.3$, N/sub u/$_2$ is comparable to the rigid mode prediction. At moderate values of ϵ ($\epsilon \gtrsim 0.3$—0.4) the second stability band disappears and the instability particle number threshold varies from the rigid stability threshold by a factor of 0.4ϵ, when $\epsilon = 0.4$, to 0.7ϵ when ϵ is about unity. The stability criteria would be consistent with the observed particle storage number obtained in experimental configurations if the spread in ϵ is sufficiently large.

21511 **Stability of plasmas sustained by ion cyclotron wave excitation in the central cell of the Tara tandem mirror.** Golovato, S.N.; Brau, K.; Casey, J.; Gerver, M.J.; Horne, S.; Irby, J.; Kesner, J.; Lane, B.; Machuzak, J.; Myer, R.; and others. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 851-861(Apr 1989).

The stability of plasmas produced by radio-frequency heating in the ion cyclotron frequency range (ICRF) has been studied in the central cell of the Tara tandem mirror [Nucl. Fusion 22, 549 (1982); Plasma Physics and Controlled Nuclear Fusion Research 1986, Proceedings of the 11th International Conference, Kyoto (IAEA, Vienna, 1987), Vol. II, p. 251]. Ion cyclotron wave excitation by a slot antenna provided stability against macroscopic plasma motions in an axisymmetric configuration. The maintenance of macroscopic stability depended on the ICRF power, gas fueling rate, ion cyclotron resonance location, and ω/ω/sub c//sub i/ at the an-

tenna location. The ICRF ponderomotive force model is consistent with many of the observed stability features and predicts that the E/sub +/ component of the ion cyclotron wave was responsible for the stabilization. The Alfven ion cyclotron microinstability was observed when the plasma β/sub perpendicular/ and anisotropy were sufficiently high. Magnetic probe measurements of the unstable mode identified it as an ion cyclotron wave and the instability threshold was within a factor of 2 of the theoretical value.

21512 **Electron velocity-space diffusion in a microunstable electron cyclotron resonance heated mirror plasma.** Hokin, S.A.; Post, R.S.; Smatlak, D.L. (MIT Plasma Fusion Center, Cambridge, Massachusetts 02139). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 862-873(Apr 1989).

An experimental study of the velocity-space diffusion of electrons in an electron cyclotron resonance heated (ECRH) mirror plasma, in the presence of microunstable whistler radio frequency (rf) emission, is presented. The dominant loss mechanism for hot electrons, with temperatures T/sub h/ ~400 keV, is end loss produced by rf diffusion into the mirror loss cone. In a case with 4.5 kW of applied power, this loss limits the stored energy to 120 J with a hot electron energy confinement time tau/sub E//sub h/ ~40 msec. The corresponding value associated with collisional scattering is 320 msec. Whistler microinstability rf induces up to 25% of the endloss. The hot electron temperature is limited by rf-induced end loss of high-energy electrons, and decreases with increasing rf power in strong diffusion regimes. Measurements of collisional loss agree with standard scattering theory. Weaker diffusion is seen in experiments in which the vacuum chamber walls are lined with microwave absorber than in experiments with reflecting walls. The presence of absorber produces two effects: (1) a smaller resonant region in velocity space due to a narrower spatial rf profile, and (2) a decreased level of random wall-reflected rf fields, which could lead to an enhancement of super-adiabatic effects. Other superadiabatic effects, however, such as the existence of a "warm" electron component with T/sub w/~E/sub s/ and a decrease of the heating rate as T/sub h/ rises above E/sub s/, where E/sub s/~30 keV is the calculated limit to fully stochastic diffusion, are not seen in the experiment.

21513 **Neutron sawtooth behavior in the PLT, DIII-D, and TFTR tokamaks.** Lovberg, J.A.; Heidbrink, W.W.; Strachan, J.D.; Zaveryaev, V.S. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 874-892(Apr 1989).

The effect of the sawtooth instability on the 2.5 MeV neutron emission in the PLT [Plasma Physics Controlled Nuclear Fusion Research, 1976 (IAEA, Vienna, 1977), Vol. I, p. 21], DIII-D [Plasma Physics Controlled Nuclear Fusion Research, 1986 (IAEA, Vienna, 1987), Vol. 1, p. 159], and TFTR [Plasma Physics Controlled Nuclear Fusion Research, 1984 (IAEA, Vienna, 1985), Vol. I, p. 29] tokamaks is studied.

21514 **Sawtooth oscillations about helical current channels.** Theobald, M.L.; Montgomery, D.; Doolen, G.D.; Dahlburg, J.P. (Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids B: Plasma Physics;* **1**: No. 4, 766-773(Apr 1989).

An existing pseudospectral code for solving the three-dimensional equations of "reduced" magnetohydrodynamics is extended by adding a temperature equation. Resistivities and thermal conductivities are given their (isotropic) Braginskii temperature dependences, and are advanced self-consistently. Realistic-looking sawtooth oscillations are observed at modest Lundquist and Reynolds numbers. However, the oscillations are excited upon, and relax back to, a helical (rather than an axisymmetric) current channel.

21515 **Achievement of reactor-relevant β in low-q divertor discharges in the doublet III-D tokamak.** Taylor, T.S.; Strait, E.J.; Lao, L.; Kellman, A.G.; Osborne, T.H.; Burrell, K.; Chu, M.S.; DeBoo, J.C.; Fukumoto, H.; Gohil, P.; and others. (General Atomics, San Diego, California 92138). *Physical Review Letters;* **62**: No. 11, 1278-1281(13 Mar 1989).

A volume average toroidal β of 6.2% has been obtained with 10 MW of hydrogen neutral beam injection into deuterium divertor discharges in DIII-D. High-β discharges were maintained quiescently for many energy confinement times in elongated, κ = 2, divertor discharges where the safety factor at the 95% flux surface was near 2. The maximum β calculated to be stable against ideal kinks and ideal ballooning modes is 8.5%—9.5%, confirming that these I/aB≅2.5 MA/m T discharges are some distance below the stability limit.

21516 **Measurement of density-sensitive electric quadrupole transitions in neonlike laser-produced plasmas.** Young, B.K.F.; Osterheld, A.L.; Walling, R.S.; Goldstein, W.H.; Phillips, T.W.; Stewart, R.E.; Charatis, G.; Busch, G.E. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review Letters;* **62**: No. 11, 1266-1269(13 Mar 1989).

We report on the measurement of density-sensitive electric quadrupole transitions in neonlike molybdenum and silver laser-produced plasmas. These observations are unique in that they represent data which are simultaneously space and time resolved. The electron densities were determined using holographic interferometry. We test the predicted density sensitivity of the electric quadrupole transitions and find excellent agreement with calculations using a detailed, steady-state, collisional-radiative model of the neonlike charge state.

21517 **MHD instabilities near the β limit in the doublet III-D tokamak.** Strait, E.J.; Lao, L.; Kellman, A.G.; Osborne, T.H.; Snider, R.; Stambaugh, R.D.; Taylor, T.S. (General Atomics, San Diego, California 92138). *Physical Review Letters;* **62**: No. 11, 1282-1285(13 Mar 1989).

Saturation or slow collapse of β is observed in DIII-D divertor discharges at high-values of normalized β [$(\beta/(I/aB) \geq 2.4$]. The sequential appearance of MHD instabilities with poloidal/ toroidal mode numbers m/n = 5/4, 4/3, 3/2, and 2/1 at progressively larger minor radii leads to the saturation or collapse of β. Only n = 2 and n = 1 modes affect global energy confinement. A model is suggested in which the instabilities originate as high-n ballooning modes near the center of the discharge, progressing to lower-n modes by modification of pressure and current profiles.

21518 **Effects of initial-state population variations on the 2p→1s Kα dielectronic satellite spectra of highly ionized iron ions in high-temperature astrophysical and laboratory plasmas.** Jacobs, V.L.; Doschek, G.A.; Seely, J.F.; Cowan, R.D. (Condensed Matter and Radiation Sciences Division, Code 4603, Naval Research Laboratory, Washington, D.C. 20375-5000). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2411-2427(1 Mar 1989).

Theoretical predictions are presented for the iron Kα x-ray emission spectra from high-temperature plasmas, assuming steady-state optically thin excitation conditions. Account has been taken of all fine-structure components of the 2p→1s inner-shell-electron radiative transitions in the iron ions from Fe XVIII to Fe XXIV. The Kα emission spectra are assumed to be produced by means of dielectronic recombination and inner-shell-electron collisional excitation processes that involve intermediate autoionizing states belonging to electronic configurations of the type $1s^1 2s/sup\ r/2p/sup\ s/$. In addition to the electron-temperature variation, which is attributable to the temperature dependences of the radiationless electron capture and inner-shell-electron collisional excitation rate coefficients and to the temperature dependence of the charge-state distribution, the Kα emission spectra exhibit an electron-density sensitivity. This electron-density sensitivity is a result of the density-dependent distribution of populations among the different fine-structure levels of the initial ions in the dielec- tronic recombination and inner-shell electron collisional excitation processes.

21519 **Observation of laser-induced anisotropic changes in the frequency and damping of ion acoustic waves in a laser plasma.** Bernard, J.E.; Baldis, H.A.; Villeneuve, D.M.; Langdon, A.B.; Rozmus, W. (Division of Physics, National Research Council of Canada, Ottawa, Ontario, Canada K1Achemical bond0R6). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 5, 2549-2560(1 Mar 1989).

Temporally and spectrally resolved large-angle Thomson scattering was used to study the frequency and damping of short-wavelength (kλ/sub D//sub e/∼1) ion acoustic fluctuations in a plasma in the presence of a high-frequency (ω$_0$>ω/sub pe/) laser beam. At high laser intensities (v/sub osc//v/sub e/>1), the frequency of the ion acoustic waves which propagated parallel to the electric field of the laser (i.e., parallel to the electron quiver velocity) was observed to be larger than the frequency of the waves which propagated in the perpendicular direction. An increase in the fluctuation amplitude for those waves that propagated parallel to the electric field was observed to be coincident with the shift in the ion acoustic frequency. Both the frequency shift and the increase in the fluctuation amplitude can be explained in terms of the off-resonance ion acoustic decay and the off-resonance oscillating two-stream instabilities. The experimental results are in good agreement with the predictions of theory.

21520 **(N—89-13528) Design study for measurement of neutral hydrogen atom density by laser induced fluorescence method.** Yamauchi, T.; Ogawa, H.; Yamada, R.; Fukuda, T. (National Aeronautics and Space Administration, Washington, DC (USA)). Sep 1988. Transl. into ENGLISH of Japan Atomic Energy Research Inst., Mar. 1987 25 p. (NASA-TT—20331; NAS—1.77:20331; JAERI-M—87-045). 36p. NTIS, PC A03/MF A01.

A system is designed to measure the fluorescence light emitted from the transitions 1S-2P of L sub alpha line (lambda=1215 A) or 2P-2S or 2P-3D of H sub alpha line (lambda=6563 A), excited by the laser induced fluorescence method. The signal-to-noise ratio (S/N) is evaluated at the measurement in the parameter (n-bar sub e = 10 to the 12th to 10 to the 14th per cu. cm, T sub e = 10 eV - 1 KeV) of tokamak plasma. The light paths in JFT-2M and JT-60 tokamaks are proposed.

21521 **A high-performance OH coil for the Los Alamos CPRF.** Weggel, C.F.; Bogart, S.L.; Dalessandro, J.A. (EASI and M.A.G.I.C., Del Mar, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1524-1527(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

A high-performance Ohmic Heating (OH) magnet has been designed for the Confinement Physics Research Facility at the Los Alamos National Laboratory. The magnet has an outside radius at its throat of 1.00 meters. At maximum current, the maximum current density is 40 amperes per square millimetre, at which point it generates 38.32 webers, single swing (or 76.6 webers, double swing), and generates a central field of 17.37 teslas. The maximum von Miess stress is 408.6 MPa (59.26 ksi). The magnet stores 637 megajoules, with a time constant of 8.30 seconds. The magnet consists of two zones: a central hour-glass-shaped coil, and an outer coil gallery of trimming coils. The central stack is built of band-sawed spirals, the construction technique which was pioneered at MIT for the OH coils for Alcater A and C. the coil uses 42 spirals, each of which is sawed from a 5-cm-thick plate of either MZC, Elbrodur, SSC-155, or OFE copper, depending on the maximum ambient stress. The inner radius of every plate is 0.60 m, and the outside radius is tangent to a toroid whose major radius is 2.00 m and whose minor radius is 1.00 m. The pitch of each spiral is adjusted to minimize the field error. The outer trimming coils are built of high-conductivity aluminum (Alloy 1350). For ease of fabrication, all but the outermost pair of trimming coils lie in a single "coil-gallery" plane and carry the same current density, so that all can be wound from a single continuous strip. The trimming coils are positioned within this gallery to yield a field error of less than 7 gauss throughout a toroidal volume centered at R/sub T/ = 2.00 meters, and whose minor radius is r/sub p/ = 0.80 meters. The current density in the trimming coils is so low that vertical diagnostic access can be provided by boring 15-cm holes through the windings themselves.

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REFER ALSO TO CITATION(S) 19596, 19873, 20232, 20784, 20785, 20786, 20787, 21466, 21494, 21496, 21503, 21516, 21521

21522 **(CONF-881031—63) Partitioning of hydrogen in the vanadium-lithium-hydrogen system at elevated temperatures.** Hull, A.B.; Chopra, O.K.; Loomis, B.A.; Smith, D.L. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007371/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Equilibrium concentrations of hydrogen in vanadium-base alloys exposed to flowing lithium at temperatures from 350 to 550{degree}C in a forced-circulation loop were measured by residual gas analysis and the vacuum fusion method. Residual gas analysis and removal of material from the surface allowed a determination of the spatial hydrogen distribution in the alloys. These experimental results were compared with calculated thermodynamic distribution coefficients for hydrogen in the vanadium/lithium system. Small amounts of other solutes in the molten lithium and in the alloys affected the solubility, diffusivity, and resultant distribution of hydrogen. Thermodynamic calculations demonstrated the importance of major alloying elements to the partitioning of hydrogen. 12 refs., 5 figs., 2 tabs.

21523 **(CONF-881031—64) On the survivability of diagnostic windows in the CIT [Compact Ignition Tokamak] reactor.** Taylor, A. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38;AC02-76CH03073. 7p. NTIS, PC A02 - OSTI. Order Number DE89007395/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The problem of radiation induced stresses in CIT diagnostic windows is discussed. Existing data indicate windows of existing design will probably survive if placed on the periphery of the reactor. There is a lack of adequate engineering data upon which the design and survivability of windows can be based. 22 refs., 5 figs., 2 tabs.

21524 **(CONF-881031—65) Influence of carbon and nitrogen impurities on the corrosion of structural materials in a flowing-lithium environment.** Chopra, O.K.; Hull, A.B. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007398/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Chemical interactions involving nonmetallic elements play a dominant role in the corrosion behavior of ferrous and vanadium base alloys in lithium. Metallographic evaluations of the surface morphology and compositional changes of lithium-exposed ferrous and vanadium alloys are presented. Data on the corrosion behavior of several ferritic, austenitic, and vanadium-based structural materials in flowing lithium are reviewed and the effects of nonmetallic elements on corrosion are discussed. 11 refs., 3 figs., 3 tabs.

21525 **(CONF-881031—66) Evaluation of liquid metal protection of a limiter/divertor in fusion reactors.** Hassanein, A.M.; Smith, D.L. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007397/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The liquid metal protection concept is proposed mainly to prolong the lifetime of a divertor or a limiter in a fusion reactor. This attractive idea for protection requires studying a wide range of problems associated with the use of liquid-metals in fusion reactors. In this work the protection by liquid-metals has concentrated on predictions of the loss rate of the film to the plasma, the operating surface temperatures required for the film, and the potential tritium inventory requirement. The effect of plasma disruptions on the liquid metal film is also evaluated. Other problems such as

liquid metal compatibility with structural materials, magnetic field effects, and the effect of liquid metal contamination on plasma performance are discussed. Three candidate liquid-metals are evaluated, i.e., lithium, gallium, and tin. A wide range of reactor operating conditions valid for both near term machines (INTOR and ITER) and for the next generation commercial reactors (TPSS) are considered. This study has indicated that the evaporation rate for candidate liquid metals can be kept below the sputtering range for reasonable operating temperatures and plasma edge conditions. At higher temperatures, evaporation dominates the losses. Impurity transport calculations indicate that impurities from the plate should not reach the main plasma. One or two millimeters of liquid films can protect the structure from severe plasma disruptions. Depending on the design of the liquid metal protection system, the tritium inventory in the liquid film is predicted to be on the order of a few grams. 16 refs., 5 figs.

21526 **(CONF-8806198—3) Reduced-activation materials for fusion reactors: An overview of the proceedings.** Klueh, R.L.; Packan, N.H.; Gelles, D.S.; Okada, M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007199/JAW.

From International symposium on reduced activation alloys for fusion service; Andover, MA, USA (29 Jun 1988).

Some of the most serious safety and environmental concerns for future fusion reactors involve induced radioactivity in the first wall and blanket structures. One problem caused by the induced radioactivity in a reactor constructed from the conventional austenitic and ferritic steels presently being considered as structural materials would be the disposal of the highly radioactive structures after their service lifetimes. To simplify the waste-disposal process, "low-activation" or "reduced-activation" alloys are being developed. The objective for such materials is that they qualify for shallow land burial, as opposed to the much more expensive deep geologic disposal. This paper reviews these classes of materials for this purpose: austenitic stainless steels, ferritic steels, and vanadium alloys.

21527 **(DOE/DP/40200—85) Computer modeling and simulation in inertial confinement fusion.** McCrory, R.L.; Verdon, C.P. (Rochester Univ., NY (USA). Lab. for Laser Energetics). Mar 1989. Contract FC03-85DP40200. 44p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008304/JAW.

The complex hydrodynamic and transport processes associated with the implosion of an inertial confinement fusion (ICF) pellet place considerable demands on numerical simulation programs. Processes associated with implosion can usually be described using relatively simple models, but their complex interplay requires that programs model most of the relevant physical phenomena accurately. Most hydrodynamic codes used in ICF incorporate a one-fluid, two-temperature model. Electrons and ions are assumed to flow as one fluid (no charge separation). Due to the relatively weak coupling between the ions and electrons, each species is treated separately in terms of its temperature. In this paper we describe some of the major components associated with an ICF hydrodynamics simulation code. To serve as an example we draw heavily on a two-dimensional Lagrangian hydrodynamic code (ORCHID) written at the University of Rochester's Laboratory for Laser Energetics. 46 refs., 19 figs., 1 tab.

21528 **(DOE/ER/52152—1) Innovative fusion reactor design analysis: Annual performance report, May 15, 1988--January 31, 1989.** Klein, A.C. (Oregon State Univ., Corvallis (USA). Dept. of Nuclear Engineering). 31 Jan 1989. Contract FG06-88ER52152. 32p. (OSU-NE—8901). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008220/JAW.

This report discusses the following topics on fusion reactor component design: FLiBe intermediate heat exchanger design analysis; FLiBe properties; design methodology; FLiBe system steam generator freezeup; FLiBe reactor systems studies; tritium breeding ratio control; analysis of original objectives; and budget analysis. 15 refs., 13 figs., 3 tabs. (LSP)

21529 **(ENEA-RT-FUS—87-35) Stability of a stiffened toroidal sector under uniform external pressure.** Pizzuto, A.; Cerreta, R.; Di Pietro, E. (ENEA, Frascati (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705436/JAW.

This paper present the results of a stability analysis on a sector of the FTU (Frascati Tokamak Upgrade) toroidal vacuum vessel. FTU is an experimental machine, now under construction, mainly devoted to the study of the effects of lower hybrid radiofrequency heating on plasmas in reactor relevant conditions. Its vacuum chamber is a stainless steel structure completely welded with a major radius of 0.935 m and a minor radius of 0.335 m consisting of 12 toroidal thin sector joined together by thick ribs. This structure is loaded by comprensive electromagnetic forces both in toroidal and in radial direction that can create instability conditions. One of the major problems in its design is to determine the points where this phenomenon is likely to occur in order to avoid dangerous buckling situations. Theoretical analysis of the stability behaviour of one of these sector has been conducted by means of the ABAQUAS finite element code. The critical load has been determined by a classical algorithm and by the modified Riks methods. Both methods have given similar results in an elastic analysis. Furthermore the second one has been applied also using an elastoplastic model of the material to determine the critical load and the post buckling behaviour of the structure. Experimental tests have been conducted on a full scale model of the toroidal sector. The model has been placed in a large tank filled with water where the pressure has been gradually increased up to the collapse of the structure. The theoretical and experimental results have been compared and a good agreement has been found between them.

21530 **(ENEA-RT-FUS—88-8) Tritium system for compact high field devices. Status report November 1987.** Roccella, M.; Bonizzoni, G.; Chiesa, P.; Ghezzi, F.; Nassi, M.; Pavesi, U.; Amedeo, P.; Boschetti, G.; Giffanti, F.; Moriggio, A. (ENEA, Frascati (Italy). Centro Ricerche Energia; Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. di Fisica del Plasma). (ENEA, Rome (Italy)). 1988. 60p. (In Italian). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705438/JAW.

Some theoretical results and the current status of the work on a prototype plant for the Tritium cycle of compact high-field tokamaks (such as, Ignitor, CIT, etc.), using the SAES Getter St 707 getter material, are described in this report. The schematics and present status of the main subplants of the cycle are reported together with some experimental results demostrating the possibility of utilizing the St 707 material to purify the inert atmosphere of the glove-boxes and the secondary containment of the double-containment metal canalization which is to eventually house the various parts of the plant. Finally, as an example, the FTU machine, under construction at ENEA Frascati, has been taken as a reference, and theoretical evaluations are given for the inventory, permeation and release of the Tritium from the first wall and the thermal shieldes of such a tokamak.

21531 **(JAERI-M—88-177) U.S./JAERI collaborative program on fusion neutronics, phase 1 fusion integral experiments, (2). Analysis.** Nakagawa, Masayuki (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Youssef, M.Z. (eds.). (Japan Atomic Energy Research Inst., Tokyo). Sep 1988. 284p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88756903/JAW.

The U.S./JAERI Collaborative Program on Fusion Neutronics is in progress using the FNS facility at JAERI. Phase I experiments of the program have been completed and independently analyzed. The predictions of key neutronics parameters were compared to measurements to derive information on the accuracy involved in the calculations of these parameters. First, measurements were performed to characterize the neutron field by the foil activations method and spectrum measurements using both TOF technique as well as NE213 and proton recoil counters. The measurements inside the Li/sub 2/O assembly included tritium production rate (TPR), foil activation and neutron spectrum measurements

above 1 MeV. Analyses for these measured parameters were performed by using two-dimensional discrete ordinates codes, DOT3.5(JAERI) and DOT4.3(U.S.) and Monte Carlo codes, MORSE-DD(JAERI) and MCNP(U.S.). The nuclear data used by JAERI were based on JENDL3/PR1 and PR2 while the U.S. calculations were based on ENDF/B-V and data evaluated at LANL for /sup 7/Li and Be. The configurations considered for the test assembly were: (a) a reference Li/sub 2/O assembly, (b) first wall preceded the Li/sub 2/O assembly with and without a coolant channel simulated by polyethylene, and (c) beryllium zone in front of the assembly as well as sandwiched between a front Li/sub 2/O zone and the main assembly. In this document, results of the analysis for these experiments are reported as Volume II. Details of the experiments and the experimental techniques applied are reported separately as Volume I.

21532 **(JAERI-M—88-182) RF conditioning of LHRF launcher on JT-60.** Ikeda, Yoshitaka; Honda, Masao; Yokokura, Kenji and others. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 52p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756905/JAW.

High power injection into plasmas without RF breakdown in a launcher is necessary for LHRF experiment on JT-60. It is very important to adopt operation for breakdown protection in the course of fabrication of the launcher and to optimize aging procedure to increase injected RF power without any damage caused to the launcher. This report discusses the cause of the breakdown in the launcher and the countermeasure to suppress it and summarizes the RF conditioning procedure to inject RF power up to 11 MW (peaked value) on JT-60 LHRF system.

21533 **(JAERI-M—88-214) Pellet injector on JT-60.** Hiratsuka, Hajime; Kawasaki, Kozo; Takatsu, Hideyuki; Miyo, Yasuhiko; Yoshioka, Yuji; Ohta, Kazuya; Shimizu, Masatsugu. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Oct 1988. 48p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756921/JAW.

A pneumatic gun type 4 pellet injector of JT-60 (JT-60 pellet injector) has been constructed in May 1988. The objective of this system is to inject the hydrogen ice pellets into plasmas. JT-60 pellet injector consists of a gun assembly, pumping units, a control system and stages. It is operated following JT-60 operation sequence. In this paper, the system configuration and the performance test results of JT-60 pellet injector are described.

21534 **(LA-UR—89-200) 6th target fabrication specialists meeting: Proceedings, June 23, 1988 Sessions.** (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 220p. (CONF-8806170—). NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006526/JAW.

From 6. target fabrication specialists' meeting; Los Alamos, NM, USA (20 Jun 1988).

The following papers were presented at the meeting: Laser Target Fabrication at the Naval Research Laboratory; High-Sensitivity Radiography Detects Very Small Defects in Laser Fusion Targets; Ablation Layer Coating on Inertial Fusion Targets at Laboratory for Laser Energetics; X-Ray Microscopy of Inertial Fusion Targets Using a Laser Produced Plasma as an X-Ray Source; A Study of Factors Affecting The Deposition of Smooth Plasma Polymers; Composite Foams; Low-Density Resorcinol-Formaldehyde Foams for Direct-Drive Laser ICF Targets; Low-Density Polystyrene Foams For Direct-Drive Laser ICF Targets; Characterization of Low-Density Materials and Their Precursers; and Low-Voltage Scanning Electron Microscopy of Target Materials. (JF)

21535 **(N—89-14842) Lunar helium-3 and fusion power.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Sep 1988. 234p. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—). NTIS, PC A11/MF A01.

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

The NASA Office of Exploration sponsored the NASA Lunar helium-3 and fusion power Workshop. The meeting was held to understand the potential of using He-3 from the moon for terrestrial fusion power production. It provided an overview, two parallel working sessions, a review of sessions, and discussions. The lunar mining session concluded that mining, beneficiation, separation, and return of He-3 from the moon would be possible but that a large scale operation and improved technology is required. The fusion power session concluded that: (1) that He-3 offers significant, possibly compelling, advantages over fusion of tritium, principally increased reactor life, reduced radioactive wastes, and high efficiency conversion, (2) that detailed assessment of the potential of the D/He-3 fuel cycle requires more information, and (3) D/He-3 fusion may be best for commercial purposes, although D/T fusion is more near term.

21536 (N—89-14842, pp 35-64) **Moon: an abundant source of clean and safe fusion fuel for the 21st century.** Kulcinski, G.L.; Schmitt, H.H. (Schmitt, Harrison H., Albuquerque, NM (USA)). Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

It is shown how helium-3 can be obtained from the moon and how its use in fusion reactors can benefit the inhabitants of this planet. The physics and technology issues associated with the use of He-3 is addressed. A description is given of He-3 distribution on the moon and of methods which could be used to retrieve it.

21537 (N—89-14842, pp 65-71) **Helium-3 blankets for tritium breeding in fusion reactors.** Steiner, D.; Embrechts, M.; Varsamis, G.; Vesey, R.; Gierszewski, P. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

It is concluded that He-3 blankets offers considerable promise for tritium breeding in fusion reactors: good breeding potential, low operational risk, and attractive safety features. The availability of He-3 resources is the key issue for this concept. There is sufficient He-3 from decay of military stockpiles to meet the International Thermonuclear Experimental Reactor needs. Extraterrestrial sources of He-3 would be required for a fusion power economy.

21538 (N—89-14842, pp 73-99) **Status of fusion research and implications for D/He-3 systems.** Miley, G.H. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

World wide programs in both magnetic confinement and inertial confinement fusion research have made steady progress towards the experimental demonstration of energy breakeven. However, after breakeven is achieved, considerable time and effort must still be expended to develop a usable power plant. The main program described is focused on Deuterium-Tritium devices. In magnetic confinement, three of the most promising high beta approaches with a reasonable experimental data base are the Field Reversed Configuration, the high field tokamak, and the dense Z-pinch. The situation is less clear in inertial confinement where the first step requires an experimental demonstration of D/T spark ignition. It appears that fusion research has reached a point in time where an R and D plan to develop a D/He-3 fusion reactor can be laid out with some confidence of success.

21539 (N—89-14842, pp 101-113) **Strategy for D/He-3 fusion development.** Santarius, J.F. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

It is concluded that deuterium/helium-3 fusion faces a more difficult physics development path but an easier technology development path than does deuterium/tritium. Early D/He-3 tests in

next generation D/T fusion experiments might provide a valuable D/He-3 proof-of-principle at modest cost. At least one high leverage alternate concept should be vigorously pursued. Space applications of D/He-3 fusion are critically important to large scale development.

21540 (N—89-14842, pp 169-192) **Commercial objectives, technology transfer, and systems analysis for fusion power development.** Dean, S.O. Sep 1988. NTIS, PC A11/MF A01. (NASA-CP—10018; E—4254; NAS—1.55:10018; CONF-8804250—).

From Lunar helium-3 and fusion power; Cleveland, OH, USA (25 Apr 1988).

Fusion is an inexhaustible source of energy that has the potential for economic commercial applications with excellent safety and environmental characteristics. The primary focus for the fusion energy development program is the generation of central station electricity. Fusion has the potential, however, for many other applications. The fact that a large fraction of the energy released in a DT fusion reaction is carried by high energy neutrons suggests potentially unique applications. In addition, fusion R and D will lead to new products and new markets. Each fusion application must meet certain standards of economic and safety and environmental attractiveness. For this reason, economics on the one hand, and safety and environment and licensing on the other, are the two primary criteria for setting long range commercial fusion objectives. A major function of systems analysis is to evaluate the potential of fusion against these objectives and to help guide the fusion R and D program toward practical applications. The transfer of fusion technology and skills from the national labs and universities to industry is the key to achieving the long range objective of commercial fusion applications.

21541 **(PSI—23) PIREX II, a new irradiation facility for testing fusion first wall materials.** Marmy, P.; Daum, M.; Gavillet, D.; Green, S.; Green, W.V.; Hegedues, F.; Pronnecke, S.; Rohrer, U.; Stiefel, U.; Victoria, M. (Paul Scherrer Institut, Villigen (Switzerland)). (Paul Scherrer Inst. (PSI), Villigen (Switzerland). Labor fuer Materialwissenschaften). Dec 1988. 20p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705581/JAW.

A new irradiation facility, PIREX II, became operational in March 1987. It is located on a dedicated beam line split from the main beam of the 590 MeV proton accelerator at the Paul Scherrer Institute (PSI). Irradiation with protons of this energy introduces simultaneously displacement damage, helium and other impurities. Because of the penetration range of 590 MeV protons, both damage and impurities are homogeneously distributed in the target. The installation has its own beam line optics that can support a proton current of up to 50 μA. At a typical beam density of 4 μA/mm/sup 2/, the damage rate in steels is 0.7 x 10/sup -5/ dpa/sec (dpa: displacements per atom) and the helium production rate is 170 appm He/dpa. Both flat tensile specimens of up to 0.4 mm thickness and tubular fatigue samples of 3 mm diameter can be irradiated. Cooling of the temperatures can be controlled between 100/sup o/ and 800/sup o/ C. Installation of an in situ low cycle fatigue device is foreseen. Beams of up to 20 μA have been obtained, the beam having approximately a gaussian distribution of elliptical cross section with 4 σ between 0.8 and 3 mm by 10 mm. Irradiations for a dosimetry program have been completed on samples of Al, Cu, Fe, Ni, Au, W, and the 1.4914 ferritic steel. The evaluation of results allows the correct choice of reactions to be used for determining total dose, from the standpoint of half life and gamma energy. A program of irradiations on candidate materials for the Next European Torus (NET) design (Cu and Cu alloys, the 1.4914 ferritic martensitic steel, W and W-Re alloys and Mo alloys), where the above mentioned characteristics of this type of irradiation can be used advantageously, is now under way. (author) 11 figs., 4 tabs., 20 refs.

21542 **(Rijnhuizen—86-163) Theory and design of a TE/sub 01/-TE/sub 11/ mode converter.** Geer, C.A.J. van der.; EURATOM - FOM Collaboration. (FOM-Instituut voor Plasmafysica, Rijnhuizen (Netherlands)). Dec 1986. 31p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88706131/JAW.

In the ECRH heating experiment on TFR at Fontenay-aux-Roses, carried out by the group FOM-CEA, 600 kW of microwave power has to be radiated into the plasma. The polarization should be parallel to the main magnetic field used for confining the plasma so that the ordinary mode is excited. The microwave power, generated by three 60 GHz gyrotrons, is transported in a circular waveguide. To keep the ohmic losses low, the TE/sub 01/-mode is used for the transport. Radiation from a truncated waveguide with this mode will not give the polarization needed. Just before launching, the TE/sub 01/-mode is therefore converted to the TE/sub 11/-mode which has a field pattern very well suited for exciting the ordinary mode. To design mode converters of this type the Maxwell equations are transformed into generalized telegraphist equations, a set of linear differential equations which is equal to the set of equations describing the currents and voltages in mutually coupled transmission lines or in mutually coupled tuned LC-circuits. Power can be transferred from one circuit to another with different resonant frequency by reversing the sign of the coupling at certain points in time. In the microwave analogon this corresponds to a change of curvature along the axis of the guide which leads to a wiggling axis. 12 refs.; 13 figs.; 75 schemes; 4 tabs.

21543 **(UCID—21623-Rev.1) Verification of shielding calculation on the DIII-D facility at La Jolla, CA: Revision 1.** Plechaty, E.F. (Lawrence Livermore National Lab., CA (USA)). 28 Feb 1989. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008651/JAW.

Shielding calculations were performed for the DIII-D facility at La Jolla to independently assess the biological dose from radiation emitted during operation. These calculations for both the fully shielded and bare configurations are in essential agreement with those done by General Atomics. In addition to the basic test problems run by General Atomics, a bare configuration with additional air outside the facility area was calculated. The addition of air to the bare configuration caused the dose at 100 meters from the DIII-D center-line to increase by fifty-five percent. The inclusion of the various elemental constituents in the soil composition may change the calculated dose, but will not change the shielding factor nor invalidate the overall conclusion of this report. The overall conclusion is that General Atomics and LLNL results are in general agreement. 5 refs., 11 figs., 5 tabs.

21544 **(UCID—21650) Linear plasma-based tritium production facility.** Coensgen, F.H.; Futch, A.H.; Molvik, A.W. (Lawrence Livermore National Lab., CA (USA)). 15 Feb 1989. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008639/JAW.

The concept presented here is an adaptation of a recently completed conceptual design of a compact high-fluence D-T neutron source for accelerated end-of-life testing of fusion reactor materials. Although this preliminary assessment serves to illustrate the main features of a linear plasma-based tritium breeder, it is not necessarily an optimized design. We believe that proper design choices for the breeder application will certainly reduce costs, perhaps as much as a factor of two. We also point out that Q (the ratio of fusion power produced to power input to the plasma) increases with system length and that the cost per kg of tritium decreases for longer systems with higher output. In earlier studies of linear two-component plasma systems, Q values as high as three were predicted. At this level of performance and with energy recovery, operating power requirements of the breeder could approach zero. 5 refs., 1 fig., 1 tab.

21545 **(UCRL—99316-Rev.1) Acoustic damage to large-aperture optics: Revision 1.** Smith, J.R.; Murray, J.F.; Kyrazis, D.T.; Wilcox, R.B.; Weiland, T.L.; Ehrlich, R.B.; Thompson, C.E.; Engle, R.B.; Brown, A.E. (Lawrence Livermore National Lab., CA (USA)). 1989. Contract W-7405-ENG-48. 17p. (CONF-890145—18-Rev.1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008025/JAW.

From SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89; Los Angeles, CA, USA (15 Jan 1989).

We have observed damage to 80-cm-diam fused-silica disks and lenses subjected to high-fluence pulses (up to 2.3 J/cm^2) from an upgraded Nova laser beamline (wavelength 351 nm; pulse duration 2.35 ns; beam diameter 70 cm; energy up to 8 kJ). Damage occurred in the center of each element, where a 6-cm-wide obscuration prevented direct illumination. We believe that light strongly scattered by transverse stimulated Brillouin scattering (SBS) interacts with the surface and with the bulk of the substrate, producing two kinds of acoustic waves that propagate to its center, where they become strong enough to do damage. In the surface interaction, scattered light is absorbed by an O-ring near the perimeter of the optic, creating a Rayleigh wave that propagates along the surface to the center of the optic. The resulting damage takes the form of crater-shaped fractures about 8 mm in diameter and 4 mm deep. In the bulk interaction, transverse SBS strongly compresses the optic in large regions transverse to the direction of beam polarization at the perimeter of the beam. The compression may result from electrostriction: the SBS intensity is several times that of the incident beam. Compressive waves resulting from the relaxation of these regions propagated to the perimeter of the optic, where they are reflected as bulk tensile waves. The focusing of these tensile waves in the center of the optic results in cracks along the direction of polarization. We propose design rules for avoiding acoustic damage in large optics and compare observed thresholds for transverse SBS with predictions in the literature. 7 refs., 8 figs., 1 tab.

21546 **(UCRL—100390) Performance and operation of the upgraded Nova laser.** Kyrazis, D.T.; Speck, D.R.; Bibeau, C.; Ehrlich, R.B.; Hermes, G.L.; Smith, J.R.; Weiland, T.L.; Wegner, P.J. (Lawrence Livermore National Lab., CA (USA)). 25 Jan 1989. Contract W-7405-ENG-48. 19p. (CONF-890145—20). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008027/JAW.

From SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89; Los Angeles, CA, USA (15 Jan 1989).

Over the past year, the Nova laser at the Lawrence Livermore National Laboratory has been undergoing major refurbishment. Concurrently, an extensive research program has been undertaken to characterize and understand, in detail, the characteristics of Nova and the factors which limit its performance. As a result of these combined efforts, Nova now exceeds its original performance goals. Among the topics discussed are the substitution of platinum free laser glass in the power amplifier section of the Nova beamlines; increased frequency conversion efficiency and large optic damage resulting from transverse stimulated Brillouin scattering. When we have implemented the necessary changes on all 10 Nova beamlines, we will soon be able to routinely deliver 120 kilojoules of energy at 1.053 μm, and 75 kilojoules at 0.351 μm. 18 refs., 7 figs.

21547 **Design considerations for single-stage and two-stage pneumatic pellet injectors.** Gouge, M.J.; Combs, S.K.; Fisher, P.W.; Milora, S.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* **60**: No. 4, 570-575(Apr 1989).

Performance of single-stage pneumatic pellet injectors is compared with several models for one-dimensional, compressible fluid flow. Agreement is quite good for models that reflect actual breech chamber geometry and incorporate nonideal effects such as gas friction. Several methods of improving the performance of single-stage pneumatic pellet injectors to muzzle velocities ranging from 2 to 2.25 km/s in the near term are outlined. Two-stage pneumatic injectors have the potential for much higher muzzle velocities (4—6 km/s) because of the higher gas pressures and temperatures achievable with the second-stage compression. The design and performance of two-stage pneumatic pellet injectors are discussed, and initial data from the two-stage pneumatic pellet injector test facility at Oak Ridge National Laboratory are presented. Finally, a concept for a repeating two-stage pneumatic pellet injector is described.

21548 **Coil requirements for control of plasma shape and divertor flux surfaces in the compact ignition tokamak (CIT).** Pillsbury, R.D. Jr.; Thome, R.J. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, MA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1512-1514(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Coal position optimization studies have been done to determine the desirable locations for coils which can compensate for selected plasma operational disturbances in the Compact Ignition Tokamak (CIT). Control of heat deposition on divertor plates will be dependent on the ability of the coils to respond, for example, to changes in plasma current profiles or β in a manner which controls the flux surfaces in the vicinity of the X-point or separatrix. In addition, it may be desirable to use the control coils to continuously oscillate the flux surfaces as they intersect the divertor plates to help distribute the heat load. This paper presents the results of studies showing the relative effectiveness of different coil locations for these functions. The need for coils internal to the toroidal field coil system is demonstrated. In addition, contour plots are given which map the region around the x-point in a general way which allows the impact of changing location to be evaluated to estimate changes in coil current requirements and facilitate trade studies.

21549 **Magnet technology for the engineering test reactor.** Henning, C.D.; Miller, J.R. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5511, L-643, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1299-1302(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The consideration for building an international Engineering Test Reactor emerged from the November 1985 Geneva Summit, in which President Reagan and Secretary Gorbachev called for the "widest practical development of international cooperation" in fusion. In parallel with the OTR design in the USSR, the FER in Japan, and the NET in Europe, the U.S. has pursued the TIBER (Tokamak Ignition/Burn Experimental Reactor). This compact design of 3-major radius is achievable because of high-current-density, radiation tolerant magnets with nuclear heating rates up to 10 mW . cm/sup -3/. Full development of cable-in-conduit conductors (CICC) is seen as a credible path to achieve 40 A . mm/sup -2/ at fields of 12 T in the toroidal field (TF) coils and 14 T in the central poloidal field (PF) coils. Since neutron fluences of up to 10/sup 19/ n . cm /sup -2/ are expected in the TF coils, the unalloyed niobium-tin would be superior at 12 T. However, the central PF coil at 14 T is better shielded, so modified niobium tin would be advantageous. Polyimide insulation in the TF coils would withstand the equivalent 10/sup 10/ rads of loads in the winding pack are taken in compression.

21550 **The LLNL HFTF - A flexible superconducting test facility for fusion magnet development.** Miller, J.R.; Chaplin, M.R.; Leber, R.L.; Rosdahl, R.A. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5511, L-643, Livermore, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1425-1428(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The High-Field Test Facility (HFTF) is a flexible and, in many ways, unique facility at Lawrence Livermore National Laboratory (LLNL) for providing the test capabilities needed to develop the superconducting magnet systems of the next generation fusion machines. The superconducting coil set in HFTF has been operated successfully at LLNL, but in its original configuration, its utility as a test facility was somewhat restricted and cryogenic losses were intolerable. A new cryostat for the coil set allows the magnet system to remain cold indefinitely so the system is available on short notice to provide high fields (about 11 T) inside a reasonably large test volume (0.3-m diam). The HFTF has become a key facility in the LLNL magnet development program, where the primary goal is to demonstrate the technology for producing fields to 15 T

with winding-pack current density of 40A . mm/sup -2/ in coils sized for fusion applications.

21551 **The IEA large coil task test results in IFSMTF.** Lubell, M.S.; Clinard, J.A.; Dressner, L.; Fietz, W.A.; Fletcher, W.M.; Haubenreich, P.N.; Lue, J.W.; Luton, J.N.; McManamy, T.J.; Schwent. (Oak Ridge National Lab., Oak Ridge, TN (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 761-766(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The Large Coil Task (LCT) is an international collaboration of the United States, EURATOM, Japan, and Switzerland to develop large superconducting magnets for fusion reactors. The testing phase of ICT was completed on September 3, 1987. All six coils exceeded the design goals, both as single coils and in six-coil toroidal tests. In addition, a symmetric torus test was performed in which a maximum field of 9 T was reached in all coils simultaneously. These are by far the largest magnets (either in size, weight, or stored energy) ever to achieve such a field.

21552 **Test results of the U.S.-LCT pool-boiling coils in the International Fusion Superconducting Magnet Test Facility (IFSMTF).** Shen, S.S.; Dresner, L.; Lubell, M.S.; Lue, J.W.; Luton, J.N.; McManamy, T.J.; Wilson, C.T.; Wintenberg, R.E. (Oak Ridge National Lab., Oak Ridge, TN (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 783-786(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The international Large Coil Task (LCT) has designed, built, and successfully tested six different toroidal field coils. Each has a 2.5- x 3.5-m D-shaped bore, a current between 10 and 18 kA, and is designed for stable operation at 8 T with a superimposed pulsed field of 0.14 T in 1.0 s and simulated nuclear heating. Included in the torus are two pool-boiling coils designed and fabricated by U.S. firms, General Dynamics/Convair Division (GD) and General Electric/Oak Ridge National Laboratory (GE). Both coils were well instrumented for studies of electromagnetic, mechanical, and thermodynamic properties. Testing of the torus started early in 1986 and was successfully completed on September 3, 1987, although the pulsed field tests with GD and GE had to be deleted from the test program because it was not feasible to devote the required few months to repair the mechanism for moving the pulse coil system to these two test coils. Both coils performed well and met design specifications. In later "extended-condition" full-array tests beyond the design values, both operated stably at 100% design current and above 9 T, even with bath temperature higher than 4.3 K. The mechanical behaviour of both coils was generally in good agreement with calculations. Both coils were also safely discharged several times in the extended-condition tests. All results indicate that the technology developed for these two pool-boiling LT coils can be directly applied for future large-scale applications.

21553 **High intensity laser-matter interactions; Proceedings of the Meeting, Los Angeles, CA, Jan. 12, 13, 1988.** Campbell, E.M.; Baldis, H. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). 188p. (CONF-8801117—).

From High intensity laser matter interactions; Los Angeles, CA, USA (12 Jan 1988).

The present conference discusses topics in the physics of intense laser output-target matter interactions, such interactions' applications, laser-plasma X-ray sources, and ultrafast phenomena and their diagnostics. Attention is given to short-pulse laser interactions with solids, atomic photoionization in intense optical fields, results from high-temperature laser-fusion compression results, laser-driven plasma accelerators, shock multiplication in multilayered targets, and the physics of condensed matter at extreme conditions. Also discussed are space- and time-resolved diagnostics of soft X-ray emission from laser plasmas, a chirped-pulse amplification teraWatt laser, the interaction of high-power femtosec pulses with gases, and C-ray sources from picosec laser plasma excitation.

21554 **Progress towards demonstration of soft X-ray amplification at shorter X-ray wavelengths.** Keane, C.; Macgowan, B.; Matthews, D.; Whelan, D. pp 105-109 of High intensity laser-matter interactions; Proceedings of the Meeting, Los Angeles, CA, Jan. 12, 13, 1988. Campbell, E.M.; Baldis, H. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). (CONF-8801117—).

From High intensity laser matter interactions; Los Angeles, CA, USA (12 Jan 1988).

Recent progress in soft X-ray laser research has been marked by significant advances in source development and X-ray laser applications. In the first area, efforts have focused on producing amplification at higher powers and shorter wavelengths. The push to shorter wavelength is closely related to efforts to demonstrate significant applications, as the utility of techniques such as X-ray laser holography is enhanced when performed with radiation in the water window between the K absorption edges of carbon (43.76 A) and oxygen (23.32 A). Recent results aimed at demonstrating gain at shorter wavelengths are presented. Results from recent recombination experiments are also discussed. 10 references.

21555 **High speed gated X-ray imagers.** Kilkenny, J.D.; Bell, P.; Hanks, R.; Power, G.; Turner, R.E. pp 147-152 of High intensity laser-matter interactions; Proceedings of the Meeting, Los Angeles, CA, Jan. 12, 13, 1988. Campbell, E.M.; Baldis, H. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). (CONF-8801117—).

From High intensity laser matter interactions; Los Angeles, CA, USA (12 Jan 1988).

The present single-frame and multiframe gated X-ray images, whose time-resolution is as fast as 150 psec, are based on the gating of microchannel plates in a stripline configuration; their gating voltage is derived from the avalanche breakdown of reverse-biased p-n junctions, thereby generating high-power voltage pulses as short as 70 psec. For use on the Lawrence Livermore National Laboratory's Nova apparatus, the microchannel plates are gated at different times and detect four gated images from an array of four pinholes. Representative results from direct-drive implosions are presented. 8 references.

21556 **X-ray sources from picosecond laser plasma excitation.** Landen, O.L.; Stearns, D.G.; Campbell, E.M.; Scofield, J.H. pp 169-176 of High intensity laser-matter interactions; Proceedings of the Meeting, Los Angeles, CA, Jan. 12, 13, 1988. Campbell, E.M.; Baldis, H. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). (CONF-8801117—).

From High intensity laser matter interactions; Los Angeles, CA, USA (12 Jan 1988).

Ultrashort (less than 10 ps at 1 keV) high-brightness (10 to the 22nd photons/sec-sq mm-eV into 2pi steradians at 1 keV) X-ray pulses are generated by exciting a preformed laser-produced plasma using a 1 GW picosecond laser pulse. Time-integrated spectra and time-integrated spatially resolved emission yields are presented for various materials. Time-resolved measurements of the XUV and X-ray emission from a solid Au target are presented, as well as the dependence of radiation yield on the laser energy, angle of incidence, and polarization. The production and short time duration of the X-ray emission is attributed to resonance absorption followed by rapid plasma cooling via thermal conduction. 11 references.

99 GENERAL AND MISCELLANEOUS

REFER ALSO TO CITATION(S) 20112

21557 **(CSCHE—8810) Book of abstracts, 38th Canadian Chemical Engineering Conference, 1988.** Wanke, S. (ed.). (Canadian Society for Chemical Engineering, Ottawa). 1988. 229p. (CONF-881038—; CE—02367). Canadian Society for Chemical Engineering, 1785 Alta Vista Drive, Ottawa, Ont., Canada K1G 3Y6; $25.00 CAN.

From Canadian Society for Chemical Engineering annual conference; Edmonton, Canada (2 Oct 1988).

A conference was held to present recent research in chemical engineering in Canada. Papers were presented in such areas of

investigation as heat transfer, bitumen and heavy oil processing, separation processes, process control, acid gas processing, enhanced oil recovery, bioengineering, fluid mechanics, chemical reactors, polymers and composites, waste recovery and treatment, colloids and emulsions, and rheology. This volume contains only the abstracts of papers presented at the conference. 99 refs., 47 figs., 2 tabs.

21558 **(INIS-mf—11900) Karlsruhe Nuclear Research Center. Research and development programme 1989. As of December 1, 1988.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1988. 482p. (In German). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756959/JAW.

The R and D activities of the KfK are classified in 10 main research activities: (1) Project fast breeder; (2) separation nozzle method; (3) project nuclear fusion; (4) project reprocessing and waste processing; (5) ultimate storage; (6) environment and safety; (7) solid-state and materials research; (8) nuclear and elementary particle physics; (9) microtechnics e.g. X-ray lithography; (10) materials handling.

21559 **(N—89-14188) Report of the In Situ Resources Utilization Workshop.** Fairchild, K.; Mendell, W.W. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). Nov 1988. 85p. (NASA-CP—3017; S—581; NAS—1.55:3017; CONF-8701160—). NTIS, PC A05/MF A01.

From In situ resources utilization workshop; Lake Buena Vista, FL, USA (28 Jan 1987).

The results of a workshop of 50 representatives from the public and private sector which investigated the potential joint development of the key technologies and mechanisms that will enable the permanent habitation of space are presented. The workshop is an initial step to develop a joint public/private assessment of new technology requirements of future space options, to share knowledge on required technologies that may exist in the private sector, and to investigate potential joint technology development opportunities. The majority of the material was produced in 5 working groups: (1) Construction, Assembly, Automation and Robotics; (2) Prospecting, Mining, and Surface Transportation; (3) Biosystems and Life Support; (4) Materials Processing; and (5) Innovative Ventures. In addition to the results of the working groups, preliminary technology development recommendations to assist in near-term development priority decisions are presented. Finally, steps are outlined for potential new future activities and relationships among the public, private, and academic sectors.

9901 Management

REFER ALSO TO CITATION(S) 21598

21560 **(CONF-8810249—3) Societal acceptance of controversial facilities: The role of two public participation strategies---negotiation and risk communication.** Wolfe, A.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007521/JAW.

From Annual meeting of the Society for Risk Analysis; Washington, DC, USA (31 Oct 1988).

Public participation in decision making about the siting of controversial facilities is viewed in contradictory ways by different groups of people. Some see public participation as an impediment, while others think it is an important mechanism in gaining societal acceptance for eventual siting. This paper discusses two strategies for obtaining societal acceptance--- negotiation and risk communication---in light of the extent to which they (1) involve members of the public; (2) focus on risk-related issues; and (3) contribute to decisions to site controversial facilities. The paper presents an integrated conceptual model for public participation in siting decisions that incorporates risk as well as social, political, and historical contexts. 20 refs., 1 fig.

21561 **(IAEA-TECDOC—488) International Centre for Theoretical Physics. Scientific activities in 1987.** (International Atomic Energy Agency, Vienna (Austria)). Dec 1988. 99p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705973/JAW.

A review of the scientific activities of the ICTP Trieste in 1987, including workshops, research and training for research is presented. The scientific program consists of eight main fields: fundamental physics, condensed matter, atomic and molecular physics, mathematics, physics and energy, physics and environment, applied physics and high technology, physics and development. In addition to a brief description of each workshop, symposium, college, meeting and activity or project sponsored by ICTP, a list of preprints and internal reports issued in 1987 is included. Tabs.

21562 (INIS-BR—1411, pp 1-7) **Calibration and dosimetry at CNEN/Sao Paulo.** Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). 1988. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88705734/JAW. (CONF-8808196—).

From Seminar on radiation protection and environmental control; Belo Horizonte, Brazil (8 Aug 1988).

The research activities at calibration and dosimetry laboratories of Instituto de Pesquisas Energeticas e Nucleares (IPEN-CNEN-SP) are described. (M.C.K.).

21563 **(INIS-GB—183) Report of the Science and Engineering Research Council for the year 1987-88.** (Science and Engineering Research Council, Swindon (UK)). Dec 1988. 112p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88706055/JAW.

The paper presents the Annual Report of the Science and Engineering Research Council (SERC), United Kingdom 1987/8. The contents contains the reports of the four Boards of the Council - the Astronomy and Planetary Science Board, the Engineering Board, the Nuclear Physics Board and the Science Board. The SERC report also contains eleven review articles on major advances in Science in recent years, including high temperature superconductivity and the supernova in the Large Magellanic Cloud, as well as details of fourteen "highlights" of 1987/8 including the dating of the Turin Shroud. (U.K.).

21564 **(INIS-GB—184) Synchrotron radiation. Appendix to the Daresbury annual report 1987/88.** Nave, C.; Quinn, P.; Blake, R.J. (comps.). (Daresbury Lab. (UK)). 1988. 153p. NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS. Order Number DE88706056/JAW.

The paper on Synchrotron Radiation contains the appendix to the Daresbury Annual Report 1987/88. The appendix is mainly devoted to the scientific progress reports on the work at the Synchrotron Radiation Source in 1987/8. The parameters of the Experimental Stations and the index to the Scientific Reports are also included in the appendix. (U.K.).

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REFER ALSO TO CITATION(S) 19310, 19803, 21463, 21477, 21602

21565 **(ANL—88-44) Otter 1.0 users' guide.** McCune, W.W. (Argonne National Lab., IL (USA)). Jan 1989. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008656/JAW.

OTTER (Other Techniques for Theorem-proving and Effective Research) is a resolution-style theorem-proving program for first-order logic with equality. OTTER includes the inference rules binary resolution, hyperresolution, UR-resolution, and binary paramodulation. Some of its other abilities are conversion from first-order formulas to clauses, forward and back subsumption, factoring, weighting, answer literals, term ordering, forward and back demodulation, and evaluable functions and predicates. OTTER is coded in C, and it is portable to a wide variety of computers. 12 refs.

21566 **(ANL—89/1) Activities and operations of the Advanced Computing Research Facility, November 1987--December 1988.** Pieper, G.W. (Argonne National Lab., IL (USA)). Jan 1989. Contract W-31109-ENG-38. 23p. Q/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008323/JAW.

This paper discusses the research activity at the Advanced Computing Research Facility (ACRF) at Argonne National Laboratory. General activity topics discussed are: Expansion of the ACRF; Scientific impact; Scientific visualization; and Educational support. 3 refs., 2 tabs. (LSP)

21567 **(ANL/EES-TM—361) Interim user's manual for FLUFIX/MOD1: A computer program for fluid-solids hydrodynamics.** Lyczkowski, R.W.; Bouillard, J.X. (Argonne National Lab., IL (USA)). Feb 1989. Contract W-31109-ENG-38. 119p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008327/JAW.

This report describes FLUFIX/MOD1, a computer program that was developed as a two-dimensional analytical tool, based on a two-fluid hydrodynamic model, for application to fluid-flow simulation in fluid-solids systems. The field equations that constitute the two-fluid model used in FLUFIX/MOD1 and the constitutive relationships required to close this system of equations, as well as the finite-difference equations that approximate these equations and their solution procedure, are presented and discussed. The global structure of FLUFIX/MOD1 that implements this solution procedure is discussed. The input data for FLUFIX/MOD1 are given, and a sample problem for a fluidized bed is described. 47 refs., 15 figs., 8 tabs.

21568 **(ANL/PPRNT—89-155) A theory of problem domains and program correctness.** Gabriel, J.R.; Chapman, R.O. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008451/JAW.

A model of a problem domain is introduced comprising a set of variable names, a language describing computations on these variables, and an abstract machine specifying the semantics of the language. The model allows hierarchical definition of an implementation at a low level of a problem defined at a high level. Several modes of real analysis, including a realistic binary computer, are given in terms of well-defined mathematical constructs. A simple, high-level problem specification is used to describe the process of hierarchical definition and proof. The primary software tool proposed for use in proofs is an existing compiler deriving a system specification from that of its parts and interconnections. 9 refs.

21569 **(ANL/PPRNT—89-156) An algebraic theory of program correctness in a problem domain.** Gabriel, J.R. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008450/JAW.

The input equivalence classes of a binary computation--those sets of input values giving rise all to the same output--are defined. It is shown that the input equivalences define a group of input/output mappings commuting with the program, and that the value space of problem domain affords an irreducible representation of this symmetry group. It follows that not only does a program define its input equivalences, but a complete set of input equivalences and one input/output pair define a program. Thus a program may be defined either by its input/output mapping or by its symmetry group, and a good specification might include both. The determination of input equivalences for a system from knowledge of its parts and their interconnections is shown to be mechanically computable in roughly the same circumstances that an input/output relation is mechanically computable. 5 refs.

21570 **(CONF-890276—1) ARK: Experiments in knowledge elicitation.** Arrowood, L.F. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007511/JAW.

From Psychology senior seminar; Knoxville, TN, USA (9 Feb 1989).

This brief memo discusses aspects of knowledge-base systems and knowledge acquisition. (LSP)

21571 **(CONF-8807156—1) A collection of nonlinear model problems.** More, J.J. (Argonne National Lab., IL (USA)). Feb 1989. Contract W-31109-ENG-38. 45p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007508/JAW.

From Summer seminar on the computational solution of nonlinear systems of equations; Fort Collins, CO, USA (18 Jul 1988).

This paper presents a collection of nonlinear problems. The aim of this collection is to provide model problems of scientific interest to researchers interested in algorithm development. The problems and their origin are described, and references are given to other papers that have dealt with these problems.

21572 **(CONF-8810262—2) A project for developing a linear algebra library for high-performance computers.** Demmel, J.; Dongarra, J.; DuCroz, J.; Greenbaum, A.; Hammarling, S.; Sorensen, D. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007501/JAW.

From Symposium on the solution of super large problems in computational mechanics; Mystic, CT, USA (18 Oct 1988).

Argonne National Laboratory, the Courant Institute for Mathematical Sciences, and the Numerical Algorithms Group, Ltd., are developing a transportable linear algebra library in Fortran 77. The library is intended to provide a uniform set of subroutines to solve the most common linear algebra problems and to run efficiently on a wide range of high-performance computers. To be effective, the new library must satisfy several criteria. First, it must be highly efficient, or at least "tunable" to high efficiency, on each machine. Second, the user interface must be uniform across machines. Otherwise much of the convenience of portability will be lost. Third, the program must be widely available. NETLIB has demonstrated how useful and important it is for these codes to be available easily, and preferably on line. We intend to distribute the new library in a similar way, for no cost or a nominal cost only. In addition, the programs must be well documented.

21573 **(CONF-8810320—1) Use of language features in the implementation and validation of a standardized generic package of elementary functions for Ada.** Tang, P.T.P. (Argonne National Lab., IL (USA)). 28 Oct 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007385/JAW.

From Sandia workshop on ADA in real-time and scientific environments; Albuquerque, NM, USA (30 Oct 1988).

The creators of Ada envisioned it to be a fine language for portable numerical programming by incorporating into Ada a formal floating-point model that is further supported by numerous environment inquiries. It is therefore somewhat ironic that there is no mention at all in the language of a library of elementary functions---one of the most basic building blocks for scientific computations. Do the language features allow such a library to be rigorously specified in the spirit of the floating-point model? If so, can a specification-conforming library be implemented portably in Ada itself? This paper is a summary of our investigations of the functions EXP and LOG pertaining to the second question. With careful use of the language features, we have shown that portable implementations are achievable, with minor qualifications. Moreover, we have also shown that the accuracy of such portable implementations can themselves be validated by programs implemented portably in Ada. The organization of this paper is as follows. We discuss the specifications and outline the implementations. We report the results of our analysis on the implementations. The idea and the implementations of the validation method are then discussed. Finally, we discuss the extension of our present work. 13 refs., 4 tabs.

21574 **(CTA-IEAV-NT—012/86) Comments on the discrepancies found in running NJOY and LINEAR - RECENT - GROUPIE for some actinides.** Corcuera, R.P.; Moraes, M. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Aug 1986. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705422/JAW.

Some discrepancies encountered between the two processing codes NJOY and RECENT-GROUPIE were analysed. It was found that they are due to different interpretation of inadequate representation of the evaluated date.

21575 **(CTA-IEAV-NT—019/86) Comparison and analysis of codes which reorganize cross sections from solved resonance parameters.** Melnikoff, M.; Carlson, B.V.; Chalhoub, E.S. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados). Dec 1986. 33p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705426/JAW.

The modifications made in the codes RECENT1 and POLLA1 are presented. The code RECENT2 is introduced. The graphical representations of the reconstructed cross sections from the Reich-Moore parameters by the codes RECENT2 and RECENT, version 1985, are compared.

21576 **(DOE/ER/13059—T1) Chaotic dynamics in nonlinear feedback systems: Final report.** Baillieul, J. (Scientific Systems, Inc., Cambridge, MA (USA)). Feb 1989. Contract AC02-83ER13059. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008108/JAW.

This report summarizes recent research on the dynamics of nonlinear feedback systems. We are primarily interested in phase portraits of such systems and the ways in which these portraits depend on parameters. Because of this, we are interested primarily in processes which have associated probability measures that are absolutely continuous with respect to Lebesgue measure. Such processes will have "interesting" phase portraits. In this paper we note that the space of piecewise constant functions is invariant under the Perron-Frobenius operator associated with any piecewise affine function. We further show that this will imply the existence of a piecewise constant probability density which is invariant for a given piecewise affine mapping satisfying certain easily checked conditions. We address the "inverse density problem:" given a density {rho} defined on some region UCR/sup n/, is it possible to find a mapping F: U → U which is ergodic on U and which admits {rho} as an invariant density? We show that an ergodic interval map cascaded with a stable linear system will, under certain conditions, results in a system having a strange attractor. For one canonical such mapping, we calculate the fractal dimension of the resulting attractor as a function of the parameters in the linear system. 15 refs., 5 figs.

21577 **(DOE/ER/25018—T1) Numerical solution of nonlinear algebraic equations in stiff ODE solving: 1986--1989 technical progress report.** Walker, H.F. (Utah State Univ., Logan, UT (USA). Dept. of Mathematics and Statistics). 1989. Contract FG02-86ER25018. 6p. NTIS, PC A02 - OSTI. Order Number DE89008284/JAW.

The original objective of this project was to investigate certain numerical methods for solving systems of nonlinear equations which arise in the implementation of implicit methods for solving stiff ODE initial-value problems. Over the course of the project, two major areas of research have developed in which most of the work has been done, viz., matrix-free methods for solving linear systems and Newton-like methods for underdetermined nonlinear systems. We describe the work in these two areas and in other areas below.

21578 **(DOE/ER/45055—12) GEN3D: A mesh generation program for 3-dimensional finite element mesh of 20 noded brick elements.** Banthia, V. K. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). [1989]. Contract FG02-84ER45055. 30p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007787/JAW.

The 3-D mesh generator program generates, from a coarse subregion mesh, a refined mesh of 20 noded brick elements. Each subregion can be independently subdivided into user prescribed number of divisions thus facilitating the generation of a graded mesh. As quadratic mapping of geometry is used, meshes with curved boundaries can be generated by suitably prescribing the coordinates of the mid-side nodes of the subregions in the subregion mesh. Also each subregion can be used to represent a volume of different material. As the subregion mesh in this case is a 3-D mesh, making it and preparing the data for the mesh generation program requires some effort. So the number of subregions must be kept as few as possible. Also for each subregion the nodal connectivity, orientation and subregion connectivity must be uniquely identified in order for the program to work. To define these a particular scheme for node and surface numbering must be used. Once the subregion mesh is ready the data for the mesh generation program should be prepared as described below. All the inputs are free format.

21579 **(K/DSRD—58) Enhanced utility of war games through AI.** Hartley, D.S. III; Algood, G.O.; Guth, M.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1989. Contract AC05-84OT21400. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008109/JAW.

The Joint Theater Level Simulation (JTLS) computer war game can be enhanced through the development of an expert system to reduce the knowledge of detail and the repetition of steps required of the user and to increase the level of strategic decisions. The model's utility can be expanded further by the construction of a cognitive-decision model developed through a rule-based system with applications of synthetic intelligence. The work on applying artificial intelligence to JTLS can be generalized to other war games. Requirements, benefits, and methodology are described. 4 refs., 2 figs.

21580 **(K/DSRD—59) The causality horizon and parallel processing for simulations with wide geographical dispersions.** Hartley, D.S. III. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1989. Contract AC05-84OT21400. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008484/JAW.

In some simulations, events that are not strictly simultaneous can be treated as if they were. Because simultaneity of events allows parallel processing with no problems of interaction or causality, enlarging the subset of the event list that can be freely processed in parallel increases the utility of a parallel architecture. It also eliminates the overhead of the rollback mechanisms of Time Warp or the waiting period required of more conservative time-synchronization methods. Even though the potential processing improvement of the causality horizon technique is less than that of completely parallel techniques, it is complementary to and can be used in conjunction with other techniques. 3 refs., 4 figs., 2 tabs.

21581 **(LA—11526-T) The use of fractal dimension for texture classification.** Dixon, K.E. (Los Alamos National Lab., NM (USA)). Apr 1989. Contract W-7405-ENG-36. 61p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008385/JAW.

This paper addresses the idea of using fractal dimension as a measure of image texture. The computation of the fractal dimension of a grey-scale image and also of the "fractal signature" of the image is presented. Two methods of scanning the image for these calculations are introduced: a line scan and a window scan. Several subsets of features extracted from the calculations are investigated as features for classification of the texture. Results from various classification experiments are presented. 5 refs., 8 tabs.

21582 **(LA-UR—89-119) Time-of-flight small-angle neutron scattering data reduction and analysis at LANSCE with program SMR.** Hjelm, R.P. Jr.; Seeger, P.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 39p. (CONF-8810182—13). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006520/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

A user-friendly integrated system, SMR, for the display, reduction and analysis of data from time-of-flight small-angle neutron diffractometers is described. Its purpose is to provide facilities for data display and assessment, and to provide these facilities in near real time. This allows the results of each scattering measurement to be available almost immediately, and enables the user to use the results of a measurement as a basis for other measurements in the same time allocation of the instrument. 8 refs., 10 figs.

21583 **(LBL—24592) Integration of a CAD/CAE/CAM operation using various software and platforms.** Millaud, J.E.; Goulding, F.S.; Obegi, G.; Whichard, A. (Los Alamos National Lab., NM (USA)). Jan 1988. Contract AC03-76SF00098. 20p. (CONF-8804247—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007659/JAW.

From Integration of a CAD/CAE/CAM operation using various software and platforms; Lyon, France (17 Apr 1988).

This paper describes how the Lawrence Berkeley Laboratory Electronic Engineering Department responded to a variety of CAD/CAE needs in the changing environment of platforms, operating systems, CAD/CAE software and in the absence of usable exchange standards. 1 ref., 6 figs.

21584 **(LBL—25343) Energy research network management workshop.** (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 446p. (CONF-880338—Summ.). NTIS, PC A19/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008847/JAW.

From Energy research network management workshop; Berkeley, CA, USA (7 Mar 1988).

This report contains presentations on computer network management. The list of presentations are: ESNET Steering Committee; Site Access Coordinator Group; Magnetic Fusion Energy; HEPNET Review Committee; High Energy Physics Technical Coordinating Committee; Energy Research DECnet Working Group; A Research and Development Strategy for High Performance Computing; Compare Functionality of DECNET, MFENET, TCP/IP; Video Movie Making Using The LBL/MFE Experimental Link; Research in Distributed Computing over Long Haul Networks; Performance Improvements and Transport Protocols; HRC Report; Panel Discussion: ESNET Management Issues; NMFECC Operations Summary; Large Systems Overview File Storage and POSIX Interface; User Support Services; Overview of the MFENET II; and Access to Supercomputers at FSU Hardware, Software Status, and Remote Access.

21585 **(LBL—25468) Cost and availability tradeoffs in replicated data concurrency control.** Kumar, A.; Segev, A. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 55p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008862/JAW.

Techniques for optimizing a static voting type algorithm are presented. Our basic optimization models are based on minimizing communications cost subject to given reliability constraints. Two models are presented; in the first model the reliability constraint is failure tolerance, while in the second it is availability. Other simpler models that are special cases of these two basic models and rise from making simplifying assumptions such as equal vote values or constant inter-site communications costs are also discussed. We describe a semi-exhaustive algorithm and efficient heuristics for solving each model. The algorithms utilize a novel signature based method for identifying equivalent vote combinations, and an efficient procedure for computing availability. Computational results for the various algorithms are also given. Finally, the optimized static algorithm was compared against the available copies method, a dynamic algorithm, to understand the relative performance of the two types of algorithms. We found that if realistic reconfiguration times are assumed, then no one type of algorithm is uniformly better. The factors that influence relative performance have been identified. 16 refs., 2 figs., 10 tabs.

21586 **(PNL-SA—15848) A tree-based approach to intelligent clustering for waveform data.** Miller, N.E.; Melton, R.B. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1988. Contract AC06-76RL01830. 5p. (CONF-890183—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007243/JAW.

From 2. international workshop on artificial intelligence and statistics; Fort Lauderdale, FL, USA (4 Jan 1989).

In this paper we present an approach for dealing with large volumes of waveform data. This approach is based on a two-phase process. In the first phase a data model is developed. In the second phase a continuous comparison is made between the data and model based expectations. As long as the two match, within a given predefined limit, the process continues. When they do not match, phase one is re-entered. The anomalous data is used to refine the model and improve its ability to generate an initial model and to generate expectations. Although the data model may be user-specified based on a priori knowledge, we present a dynamic modeling process that has the ability to incorporate changes in the data observed over time. In the case of a priori model specification, this analysis simplifies to template matching. 5 refs., 2 figs.

21587 **(SAND—89-0270C) A multiphase model for compaction-induced combustion of ball propellants.** Baer, M.R.; Nunziato, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 10p. (CONF-890260—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006999/JAW.

From JANNAF propulsion systems hazards subcommittee meeting; San Antonio, TX, USA (21 Feb 1989).

In this work, compaction-induced combustion in packed beds of nitrocellulose-based ball propellants is modeled using a multiphase mixture description. This model is applied to conditions simulating low-velocity impact experiments of Sandusky, et. al. (NSWC). A two- stage combustion model is used whereby compressive reaction begins at the compaction front. Subsequent energy release is delayed following an induction rate law based on time-to-reaction experimental data. Given conditions of sufficient energy release and heat transfer, grain burning is initiated when granular surface temperatures exceed decomposition conditions. Numerical solutions of the one-dimensional multiphase conservation equations are obtained using an adaptive finite element method and calculations are compared to experiments investigating various impact loading conditions on the ball propellants TS3659 and WC140. 11 refs., 12 figs., 1 tab.

21588 **(UCRL—99088) Parallel issues relating to domain decomposition techniques for solving PDE's.** Ferretta, T.; Nolan, M.; Rodrigue, G. (Lawrence Livermore National Lab., CA (USA)). 6 Jul 1988. Contract W-7405-ENG-48. 7p. (CONF-8808155—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008890/JAW.

From International Federation of Information Processing (IFIP) working group 2.5; Stanford, CA, USA (25 Aug 1988).

This paper discusses the following issues relating to solving partial differential equations on array processors: domain decomposition; Schwarz methods; numerical Schwarz methods; and Fourier frequency acceleration. 5 refs. (LSP)

21589 **(UCRL—99891) Computer aided interactive analysis of etiological breast cancer factors.** Moore, D.H. II. (Lawrence Livermore National Lab., CA (USA)). 30 Dec 1988. Contract W-7405-ENG-48. 60p. (CONF-881259—1). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89006138/JAW.

From 4. international symposium of the International Society Against Breast Cancer; Paris, France (5 Dec 1988).

The programs described here are designed to let an individual play with the data. They are interactive. One gets immediate feedback and it is in a visual form so one can actually see what happened rather than having to figure it out from reams of printed numbers. These programs happen to run on a Macintosh computer but similar programs are available on other personal and mini computers. The programs are described briefly. One program is Data Desk, written by a statistics professor at Cornell University. It is the most general of the three. Another program, called MacSpin, is famous in the Macintosh community because it was the first to allow three dimensional visualization of data on a personal computer. It was written by a mathematician at the University of California in Berkeley. The third program, MapMaker, will take your data and plot it on a geographic map. This is proving to be quite useful in studying cancer rates in various locations.

21590 **(UCRL—100298) New developments in the numerical solution of differential/algebraic systems.** Petzold, L.R. (Lawrence Livermore National Lab., CA (USA)). Apr 1987. Contract W-7405-ENG-48. 18p. (CONF-8704369—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008022/JAW.

From AMS-SIAM-IMA summer seminar on computational aspects of VLSI design; Minneapolis, MN, USA (1 Apr 1987).

In this paper we survey some recent developments in the numerical solution of nonlinear differential/algebraic equation (DAE) systems of the form $0 = F(t,y,y')$, where the initial values of y are known and $\partial F/\partial y'$ may be singular. These systems arise in the simulation of electrical networks, as well as in many other applications. DAE systems include standard form ODEs as a special case, but they also include problems which are in many ways quite different from ODEs. We examine the classification of DAE systems according to the degree of singularity of the system, and present some results on the analytical structure of these systems. We give convergence results for backward differentiation formulas applied to DAEs and examine some of the software issues involved in the numerical solution of DAEs. One-step methods are potentially advantageous for solving DAE systems with frequent discontinuities. However, recent results indicate that there is a reduction in the order of accuracy of many implicit Runge-Kutta methods even for simple DAE systems. We examine the current state of solving DAE systems by implicit Runge-Kutta methods. Finding a consistent set of initial conditions is often a problem for DAEs arising in applications. We explore some numerical methods for obtaining a consistent set of initial conditions. 21 refs.

21591 **(UCRL—100353) Systolic implementation of neural networks.** De Groot, A.J.; Parker, S.R. (Lawrence Livermore National Lab., CA (USA)). Jan 1989. Contract W-7405-ENG-48. 10p. (CONF-890145—19). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008031/JAW.

From SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89; Los Angeles, CA, USA (15 Jan 1989).

The backpropagation algorithm for error gradient calculations in multilayer, feed-forward neural networks is derived in matrix form involving inner and outer products. It is demonstrated that these calculations can be carried out efficiently using systolic processing techniques, particularly using the SPRINT, a 64-element systolic processor developed at Lawrence Livermore National Laboratory. This machine contains one million synapses, and forward-propagates 12 million connections per second, using 100 watts of power. When executing the algorithm, each SPRINT processor performs useful work 97% of the time. The theory and applications are confirmed by some nontrivial examples involving seismic signal recognition. 4 refs., 7 figs.

21592 **Representation of lattice quadrature rules as multiple sums.** Sloan, I.H.; Lyness, J.N. (Department of Chemistry, Massachusetts Institute of Chemistry, Cambridge, Massachusetts 02139). *Mathematics of Computation;* **52**: No. 185, 81-94(Jan 1989).

We provide a classification of lattice rules. Applying elementary group theory, we assign to each s-dimensional lattice rule a rank m and a set of positive integer invariants n_1 n_2....,n/sub s/. The number $\nu(Q)$ of abscissas required by the rule is the product $n_1n_2...$n/sub s/, and the rule may be expressed in a canonical form with m independent summations. Under this classification an N-point number-theoretic rule in the sense of Korobov and Conroy is a rank m = 1 rule having invariants N, 1,1,...,1, and the product trapezoidal rule using n/sup s/ points in rank m = s rule having invariants n,n...,n. Besides providing a canonical form, we give some of the properties of copy rules and of projections into lower dimensions.

21593 **Mode-dependent finite-difference discretization of linear homogeneous differential equations.** Kuo, C.C.; Levy, B.C. (Dept. of Mathematics, Univ. of California, Los Angeles, CA (US); Dept. of Electrical Engineering and Computer Science, Univ. of California, Davis, CA (US)). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 6, 992-1015(Nov 1988).

A new methodology utilizing the spectral analysis of local differential operators is proposed to design and analyze mode-dependent finite-difference schemes for linear homogeneous ordinary and partial differential equations. The authors interpret the finite-difference method as a procedure for approximating exactly a local differential operator over a finite-dimensional space of test functions called the coincident space, and show that the coincident space is basically determined by the nullspace of the local differential operator. Since local operators are linear and approximately with constant coefficients, the authors introduce a transform domain approach to perform the spectral analysis. For the case of boundary-value ordinary differential equations, (ODEs), a mode-dependent finite-difference scheme can be systematically obtained. For boundary-value partial differential equations (PDEs), mode-dependent 5-point, rotated 5-point, and 9-point stencil discretizations for the Laplace, Helmholtz, and convection-diffusion equations are developed. The effectiveness of the resulting schemes is shown analytically, as well as by considering several numerical examples.

21594 **On-line control of surface contamination during gas tungsten arc welding.** Lin, T.T.; Lin, H.T.; Chin, B.A. (Auburn Univ., Dept. of Mechanical Engineering, Auburn Univ., AL (US)). *Optical Engineering;* **27**: No. 5, 413-419(May 1988).

The objective of this research is to apply infrared sensing techniques, artificial intelligence, and robotics to improve the welding process by on-line identification and mitigation of weld plate surface contamination. A method of in-process detection of surface contaminants during the gas tungsten arc welding of steel plate has been developed, and rudimentary corrective actions have been implemented to demonstrate closed-loop control. The study employed on-line IR sensing techniques to dynamically monitor the thermal field in front of the molten pool during the welding process. Changes in thermal pattern and in the area under thermal scans taken perpendicular to the weld seam were then used by the controlling computer to identify undesirable surface contaminants. Appropriate corrective actions were generated and employed to displace the contaminants from the welding path. A computer routine was developed that recognized changes in the thermal patterns due to surface contaminants and implemented corrective procedures. The results of this study will aid in the elimination of weld defects due to surface contamination and hence will increase the reliability and productivity of the welding process.

21595 **The effect of magnetic impurities and barriers on the magnetization and critical current of fine filament NbTi composites.** Ghosh, A.K.; Sampson, W.B.; Gregory, E.; Kreilick, S.; Wong, J. (Brookhaven National Lab., Upton, NY (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **24**: No. 2, 1145-1148(Mar 1988). (CONF-870901—).

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

It has been shown that the highest critical currents in fine filament NbTi conductors are obtained when the filaments are closely spaced. However, the filaments in a composite with a high purity copper matrix tend to be coupled via the "proximity effect" as the filament spacing is reduced leading to large magnetization at low fields. To reduce the "proximity" coupling, trial billets of NbTi have been fabricated with Cu-30% Ni matrix, Cu-0.5% Mn matrix and one with a Ni barrier around the filaments. Wires drawn from these billets have shown that this interfilament coupling can be suppressed for very small filament separations. A full sized commercial bullet with Cu-0.5% Mn matrix demonstrates that high J/sub c/ conductors with filament size — 1-5 μm can be fabricated which show no interfilament coupling at low fields.

21596 **Practical support for parallel programming.** DiNucci, D.C.; Babb, R.G. II. (Dept. of Computer Science and Engineering, Oregon Graduate Center, Beaverton, OR (US)). pp v of Proceedings of the twenty-first annual Hawaii international conference on system sciences. Shriver, B.D. Piscataway, NJ; IEEE Service Center (1988). (CONF-880114—).

From 21. annual Hawaii international conference on system sciences; Kailua-Kona, HI, USA (5 Jan 1988).

Current approaches to programming parallel computers fall into two main categories: automatic parallelization and hand-coded parallel synchronization. A third approach has been gaining in popularity in which programs written within a higher-level parallel model are automatically transformed for execution on a particular (parallel) processor. Since the transformation process can be adapt-

ed for different parallel computers, parallel programs can be made both highly portable and efficient. This paper describes one such approach based on an improved version of Large-Grain Data Flow techniques. The model is described, along with a scheduler implementation strategy for shared-memory multi-processors. Performance measurements of a specific implementation for the Sequent Balance 21000 are given. The authors argue that this approach can provide the software engineering benefits of user-visible parallelism while avoiding the well-known pitfalls inherent in "bare-knuckles" handcoding of parallel scheduling schemes.

21597 **Neural networks can design neural networks.** Guez, A.; Portopopescu, V.; Barhen, J. (Oak Ridge National Labs., TN (US)). pp v of Proceedings of the IEEE international symposium on intelligent control 1987. Meystel, A.; Luh, J.Y.S. Piscataway, NJ; IEEE Service Center (1987). (CONF-8701100—).

From IEEE international symposium on intelligent control; Philadelphia, PA, USA (19 Jan 1987).

An important aspect in the design of nonlinear continuous neural networks is shown to have the characteristics of constraints satisfaction and linear programming problems the solution of which was implemented by researchers via neural networks. This leads us to designing networks architecture, whereby a Learning/Adaptation neural network performs the design of a Production neural network, and feedforwards its proposed architecture. Through interaction with the environment and higher hierarchical levels, the Production network generated feedback signals, possibly imposing redesign iterations and performance optimization on the Learning network.

9903 Information Handling

REFER ALSO TO CITATION(S) 19492, 19507, 19539, 19697, 19719, 20234, 20495

21598 **(DOE/MA—0351) Information technology resources long-range plan: FY 1990--FY 1994.** (USDOE Assistant Secretary for Management and Administration, Washington, DC). Dec 1988. 325p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007784/JAW.

The principle objective of the Information Technology Resources Plan is to describe the information technology resources and capabilities of the Department, the future requirements, and the strategies and plans to satisfy the identified requirements. The long-range planning process provides the systematic means to meet this objective and assists the Department in assuring that information technology support is provided in an efficient, effective, and timely manner so that the programmatic missions can be accomplished. Another important objective of the Plan is to promote better understanding, both within and external to the Department, of its information technology environment, requirements, issues, and recommended solutions as well as a description of the Departmental unclassified computer security program. 50 figs., 18 tabs.

21599 **(K/DSRD—55-Vol.1) Automated library systems and document tracking systems: Commercial software alternatives: Volume 1.** Phillips, J.T.; Tarrant, P.M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1989. Contract AC05-84OT21400. 138p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007716/JAW.

Automated Library Systems (ALS) have become complex and powerful applications, and they are increasingly selected as appropriate solutions to the challenge of tracking reports and other documents within organizations. The present ALS prototype at the Pacific Missile Testing Center (PMTC) at Point Mugu, California, was developed in-house and has been in existence for some time. However, with an expected change in the present computing environment on which the ALS presently resides (UNIVAC 1100), a discussion of the features of potential commercial software alternatives was requested. The purpose of this study was to provide an information base of presently available software systems that are similar in operation or capabilities to the present ALS at PMTC. A future step will entail review of this data and begin a selection process. Various Automated Library Systems and Automated Records Management Systems were profiled to allow comparison of their features to the present system. A bibliography of selected readings was provided to assist the PMTC in its initial effort to assess future needs. 26 refs.

21600 **(SAND—89-0532C) Migration strategies roles for data management in CIM.** Bray, O.H. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 8p. (CONF-890366—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008112/JAW.

From 5. international congress on CIM databases; Boston, MA, USA (19 Mar 1989).

This paper describes the migration path a company goes through as it moves up the data management learning curve. This migration path is based on four distinct roles for data management in CIM. The first two sections review the justification for CIM and data management. The first section describes the changing competitive environment manufacturers face and how CIM addresses the problems this situation creates. The second section identifies the two key characteristics of a database management system and the benefits provided. The third section identifies and discusses the four roles for data management in CIM. These four roles and their variations provide snapshots of where a company is on the data management learning curve. The fourth section describes the migration path a company goes through as it moves up the learning curve. Although there are similarities, there are some significant differences between this learning curve and the one experienced by MIS as it adopted data management technology. 3 refs.

21601 **(SAND—89-0533C) Information engineering: How Sandia is developing the CIM database (the NIAM [Nijssen Information Analysis Methodology] approach).** Sharp, J.K.; Orman, J.L.; Stevens, N.H. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 18p. (CONF-890366—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89007976/JAW.

From 5. international congress on CIM databases; Boston, MA, USA (19 Mar 1989).

The activities involved in establishing an integrated CIM database at Sandia National Laboratories (SNL) are centered around the development of information engineering techniques. Several information engineering techniques were investigated including: top-down/bottom-up, data flow, entity-attribute and binary models. Most of the techniques were rejected because they did not capture all of the required information or they captured information that was not needed in the development of the CIM database. All current modeling activity is required for database development. This paper describes the modeling methodology utilized, the information engineering practices being developed, and a distributed database implementation at SNL. 10 refs., 12 figs.

21602 **(UCRL—21177) Lockheed Aeronautical Systems Company technical order transfer tests.** (Lawrence Livermore National Lab., CA (USA); SYSCON Corp., San Diego, CA (USA)). 15 Dec 1988. Contract W-7405-ENG-48. 67p. (AITI—88-001). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89008092/JAW.

The AFLC/AITI Standards Project has been testing the Military Standard for the Automated Interchange of Technical Information, MIL-STD-1840 (the Standard). The objective of these tests has been to demonstrate the validity of the transfer protocol defined in the Standard itself and the viability of standardized formats for the transfer of technical information employed in other specifications used by the Standard. This test is the last in the series based on the original Standard. Future tests will use MIL-STD-1840A as the reference. Lockheed Aeronautical Systems Company (LASC), Georgia Division, used its publications laboratory to prepare text and illustrations representing the data and format of several types of Air Force technical manuals. This cross section of styles and formats was prepared on two different composition systems and three illustration systems. All text was SGML-encoded, and illustrations were prepared as IGES files or as CCITT Group IV raster files. 2 figs., 3 tabs.